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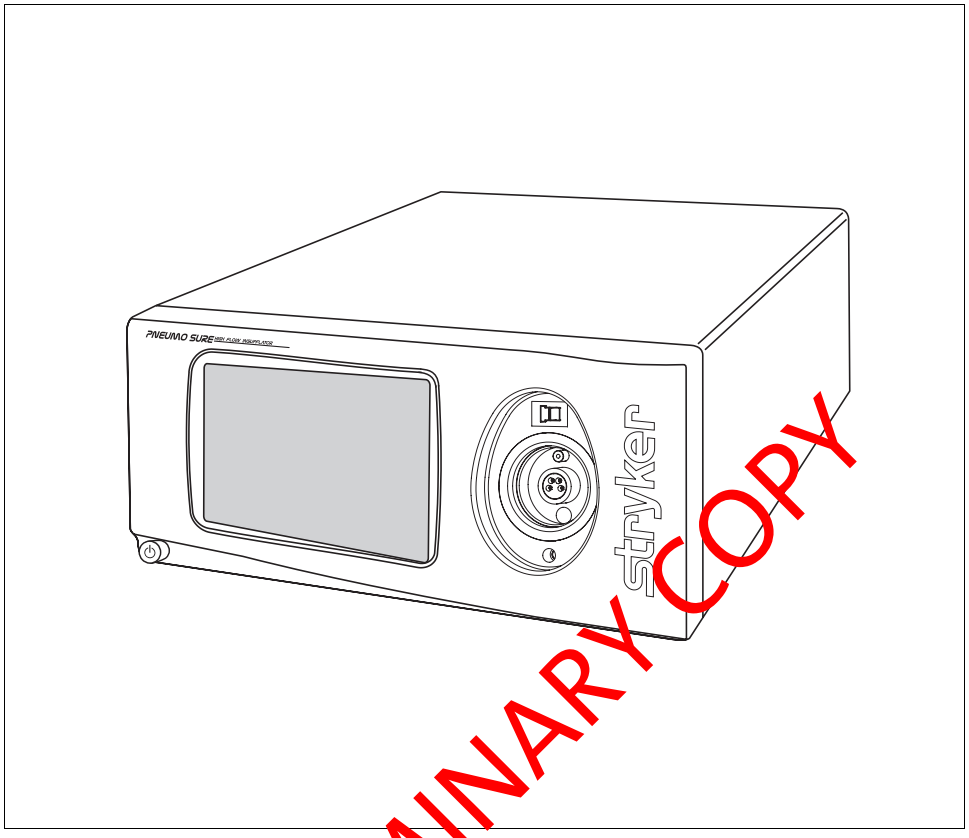
Service Manual EN

Service Handbuch DE

PNEUMO SURE HIGH FLOW INSUFFLATOR



Insufflator for Laparoscopy and Vessel Harvesting

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1 Safety Instructions

DANGER!
Before opening the device, disconnect device from power supply by pulling the power cable.

1.1 Liability

Device and accessories have been carefully inspected at the factory before shipping. However, the manufacturer is only liable for safety and reliability as well as functionality if all inspections and repairs have been performed by authorized technicians and if the device and the accessories are used only as intended.

WARNING!
All maintenance and repair tasks as well as any modifications are to be performed only by personnel or technicians authorized by the manufacturer. The power supply has to be installed in compliance with DIN/IEC.

An authorized service technician has to inspect and service the device to ensure the safety and functionality of the device every two years. If the service interval is not maintained, the manufacturer does not assume any liability for the functional safety of the device. Authorized service technicians are trained and certified only by the manufacturer. The manufacturer is not liable for direct or consequential damages, and the warranty becomes null and void if:

- the device or the accessories are used improperly;
- the instructions and rules in the manual are not adhered to;
- the device or the accessories are improperly prepared or maintained;
- unauthorized persons perform repairs, adjustments, or alterations on the device or accessories;
- the prescribed inspection and maintenance schedules are not adhered to.

The service and maintenance of the device and its accessories has to be carried out as per instructions to ensure the safe operation of the device. Check function and completeness of the device after every service or maintenance activity to ensure the safety of the patient and user/operator are not affected or diminished in any way. Factory-new and repaired products must be prepared and tested according to the manual prior to use.

1.2 Certification/Seal

The operator of the device has to receive a certificate from the service technician stating the type and scope of the performed service or maintenance tasks. This certificate must list the date of the service or maintenance task as well as the company and signature. Please use the maintenance and checklist enclosed in back of the service manual. After the repair work is concluded, a **service seal** will be attached to the device by the authorized service technician.

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2 Before Commencing Work

Environmental conditions

Please familiarize yourself with the safety notes listed in the enclosed device manual as well as local safety rules and regulations before commencing any work.

- The ambient temperature must be between 10 °C and 40 °C.
- The relative humidity must be between 30% and 75%.
- Place the device on a level surface in a dry environment.
- Before operating the device, make sure the installation area is free of materials subject to or the cause of electrostatic electricity, e.g., floor coverings.

2.1 Technical/Professional Requirements

All service tasks such as safety inspections (SI), maintenance, and repair work must be performed by personnel trained and authorized by Stryker. The following is required:

- Knowledge of all safety-relevant rules and regulations necessary to operate insufflation devices.
- Knowledge of the current technical developments and the software status.
- Knowledge of electro technical and electronic devices and processes.
- Knowledge about the use of electrical test and measurement equipment.
- Good mechanical skills.
- Stryker service technician certificate

2.2 Tools and Test Equipment

Make sure the measuring instruments are calibrated and in perfect working order before starting any maintenance tasks. The following tools and measuring instruments must be kept readily available:

- Multimeter: Voltage up to 1000 V AC/DC, electric current 10 A, with ohmmeter and continuity tester
- ESD protective mat, antistatic wristband, cable
- Serial 9-pin 1:1 PC cable
- Manometer measurement range 0-100 mm Hg, measurement class 1.0
- Manometer measurement range 0-7 bar, measurement class 1.6
- Manometer measurement range 0-100 bar, measurement class 1.6
- Flow column range 0-50 l/min CO_2, calibrated in slpm (standard liter per minute) 24 °C/1013 mbar, max. pressure drop at 9l/min < 10 mbar
- Safety test measuring instruments/tools
- Screwdrivers: 2x Phillips (medium), 2x slotted (medium)
- Socket wrench SW5, SW5, 5, SW7, SW10
- Gas bottle (pressure >50 bar)
- Jaw wrench: SW5, 5, SW7, SW24
- Allen wrench: SW2, SW4
- Box wrench for M18x1
- Side nippers: Small
- Assembly wrench for tube connection
- Tweezers or pointed pliers
- Calibration adapter
- Device manual
- Service manual
- Windows 9x or later, Windows NT4 with Service Pack 2 or later
- IBM PC or compatible with CD drive
- Device software (CD)
- Internet access
- Medical Product Brochure (MPB)*

  *localized

2.3 Supplemental Resources

Supplemental resources

The following supplemental tools, test resources, and measurement instruments are required to perform the service and maintenance routines described in this manual.

- Calibration adapter
- T-adapter 6x6x6 mm with venting valve
- Internet access for software update via GlobalServices.net ***www.womservice.com***

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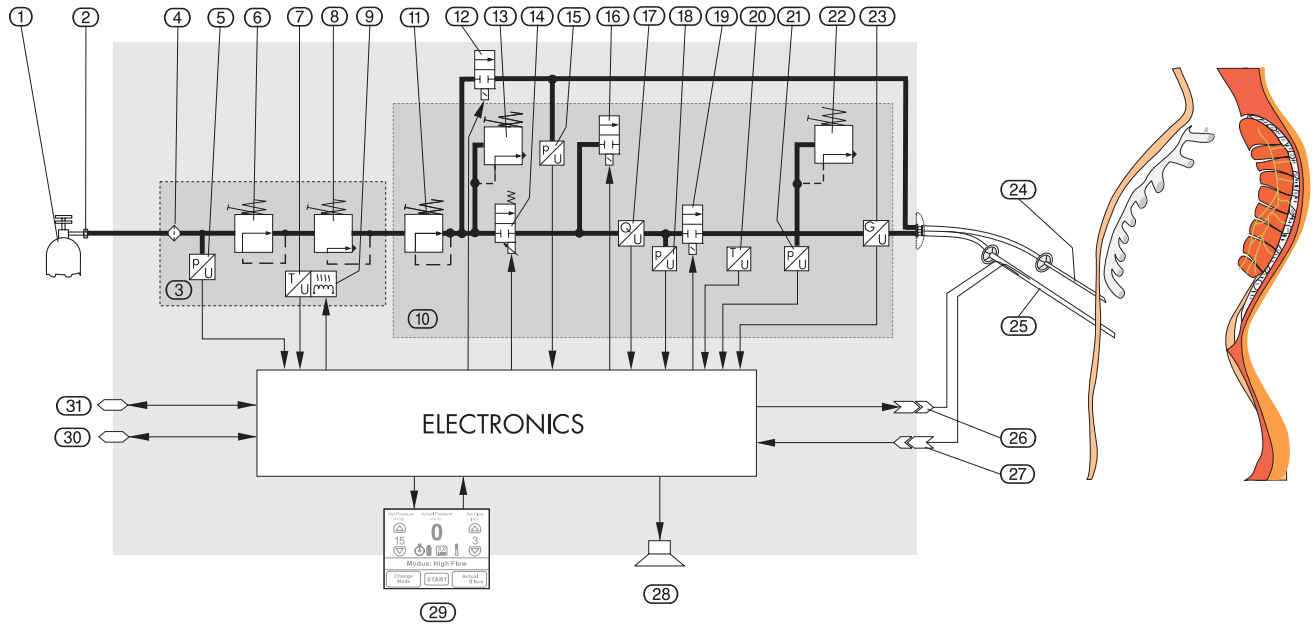
3 Device Setup

3.1 Pneumo Sure Function Diagram



	①	Gas supply	⑰	Flow sensor (DPS)
	②	Gas bottle connection	⑱	Pressure sensor II (PMS)
	③	High pressure unit (HPU)	⑲	Output line valve (OLV)
	④	Gas inlet filter	⑳	Temperature sensor (STS)
	⑤	High pressure sensor 60 bar (HPS)	㉑	Pressure sensor III (PWS)
	⑥	High pressure regulator 2 bar (HPR)	㉒	Low pressure safety valve 80 mm Hg (LSV)
	⑦	High pressure temperature sensor (HTS)	㉓	Fluid sensor (FLS)
	⑧	High pressure safety valve 3.5 bar	㉔	Connection for RTP system
	⑨	Gas heating for high pressure unit (HPH)	㉕	Insufflation tube connection
	⑩	Low pressure unit (LPU)	㉖	Heater coil for gas heating
	⑪	Low pressure regulator 120 mm Hg (LPR)	㉗	Temperature sensor for gas heating
	⑫	Patient pressure valve (PPV)	㉘	Loudspeaker
	⑬	Median pressure safety valve 500 mm Hg (MSV)	㉙	Display touch panel (LCD)
	⑭	Proportional valve (PRV)	㉚	SIDNE interface
	⑮	Pressure sensor I (PMS)	㉛	Service interface (SRV)
	⑯	Venting valve (VEV)		

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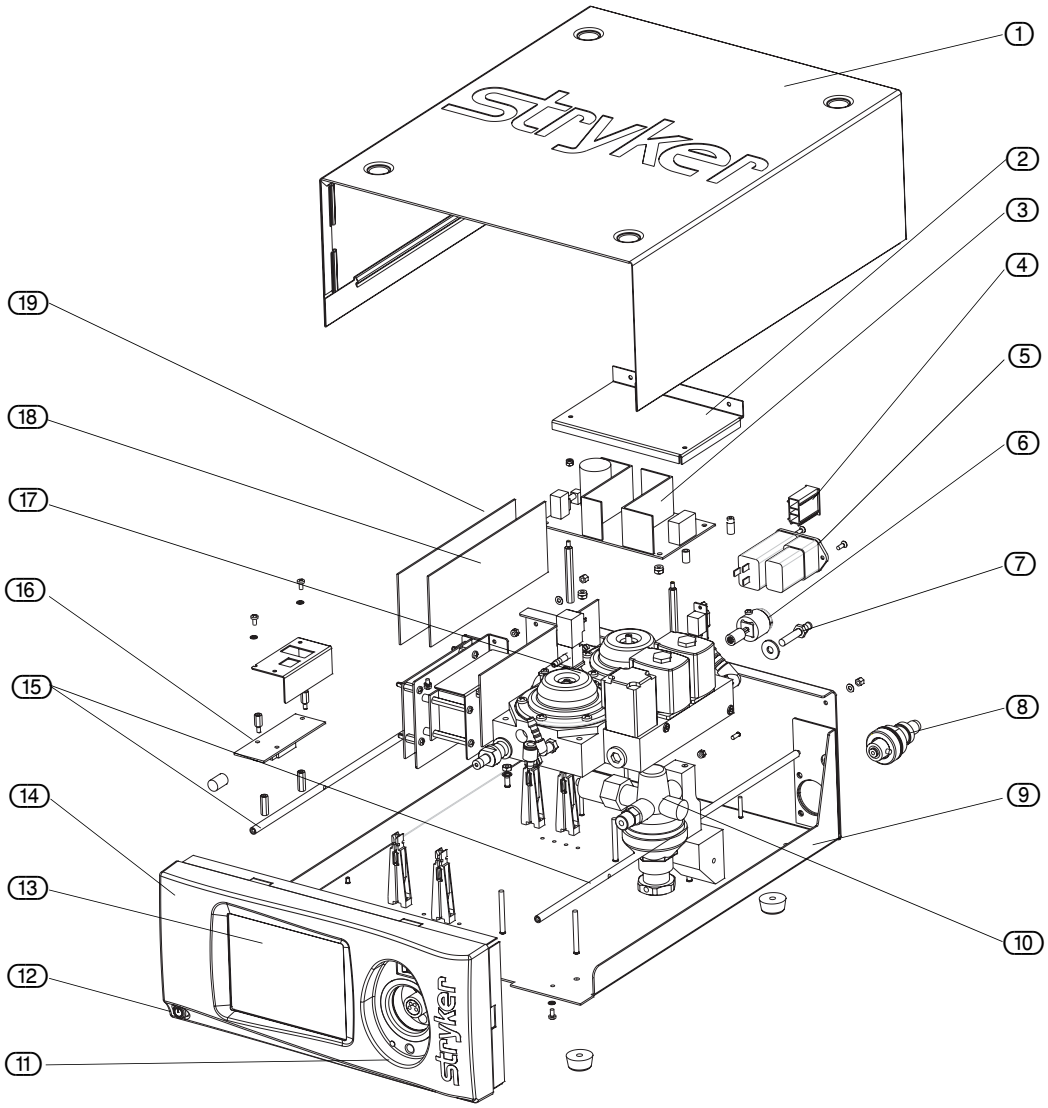
3.2 Mechanical Construction of the Pneumo Sure



①	Case lid	⑪	Tube connection
②	Cover plate for power supply unit	⑫	ON/OFF power switch
③	Power supply controller board	⑬	Display touch panel
④	Fuse holder	⑭	Faceplate
⑤	Mains socket	⑮	Con-rods
⑥	SIDNE interface (optional)	⑯	NET board (power switch)
⑦	Potential equalization MC-plug, USA	⑰	Low pressure unit (LPU)
⑧	Gas connection US	⑱	BAM board
⑨	Lower part of case	⑲	IFM board (optional)
⑩	High pressure unit HPU		

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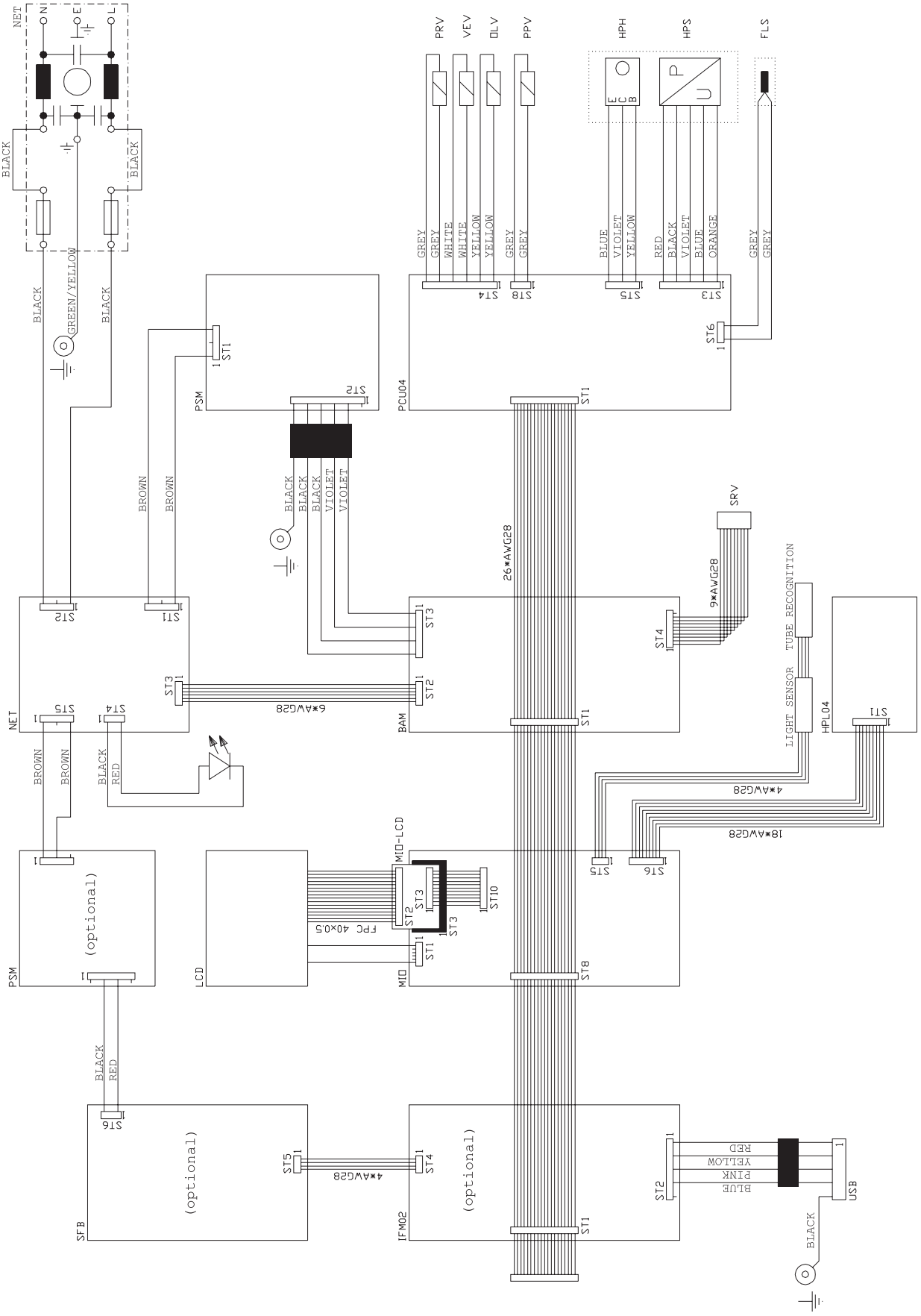
3.3 Pneumo Sure Wiring Diagram



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3.4 Device Front

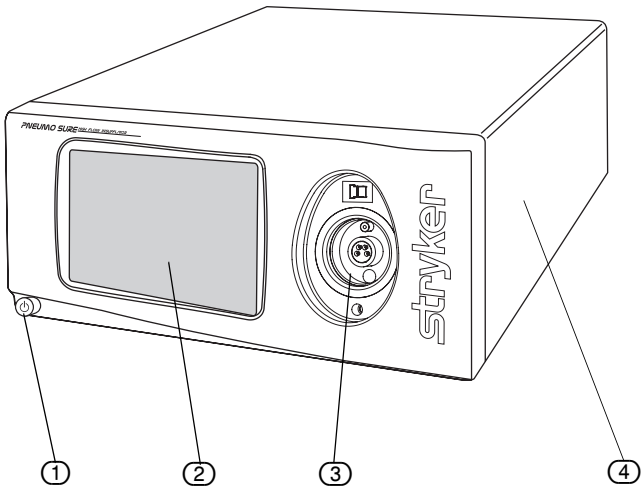

Fig. 3-1 Front view of the device

1. ON/OFF power switch
2. Display touch panel (LCD)
3. Tube connection
4. Case lid

3.5 Device Rear

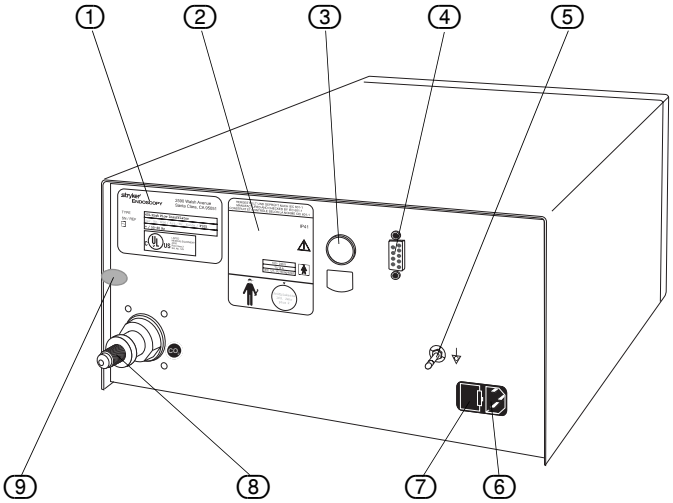

Fig. 3-2 Rear view of the device

1. Type plate
2. Device data plate
3. SIDNE interface
4. Service interface
5. Potential equalization plug
6. Mains socket
7. Fuse holder
8. Gas supply connection, US
9. Service seal

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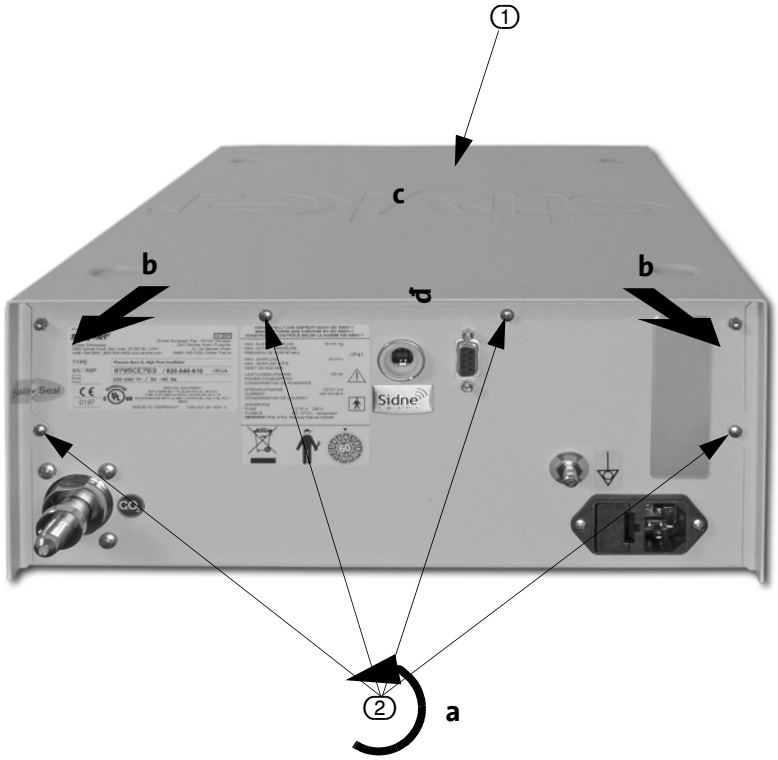
3.6 Opening the Device

Fig. 3-3 Opening the device

① Case lid

② 4x Phillips screws



DANGER!

Disconnect device from power supply.

You need a crosstip (Phillips) screwdriver size 2 to open the device. Follow the steps depicted in Fig. 3-3:

a. Turn the four Phillips screws ② counterclockwise to remove them from the rear of the device.
b. Slightly lift the case lid ① and pull off approx. 3 cm towards rear.
c. Remove case lid ① completely by lifting up.

Follow these steps in reverse for assembly.

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4 Maintenance and Service Tasks

Two-year maintenance interval

An authorized service technician has to inspect and service the device at appropriate intervals to ensure the safety and functionality of the unit. The **minimum** service interval is two years, depending on frequency and duration of use. If the service interval is not maintained, the manufacturer does not assume any liability for the functional safety of the device. A sticker located on the rear panel of the device will remind you of the latest date for the next service or maintenance check.

Annual inspection

Maintenance and service include the tasks associated with the annual inspection (see device manual). The annual inspection thus includes the following tests and checks described in detail in chapter 13 of the device manual:

- Safety Test
- Basic function test
- Pressure sensor test
- Pressure monitoring test
- Venting valve test
- Max. device pressure test
- Gas flow rate test

Certificate

Issue a certificate after inspecting the unit or performing any service tasks. This certificate lists the type and scope of the service as well as the date and name of the servicing company together wit the signature of the service technician.

4.1 Safety Test

A safety test has to be carried out by a trained technician within the scope of the annual inspection.

A visual inspection must be performed. Of particular importance is that

- the fuse corresponds with the specifications indicated by the manufacturer,
- labels and stickers on device are legible,
- the mechanical condition of the device allows for its safe use,
- the device is clean to ensure proper and safe functionality.

Measure leakage currents according to DIN EN 60601-1/IEC 60601-1.

Measure protective conductor resistance according to DIN EN 60601-1. The protective conductor resistance is measured while device is connected to the power supply. The max. value is 0.2 Ω. Measure the insulation resistance with 500-700 V DC. The min. value is 50 MΩ. The measurement of voltage stability should not be performed using high voltage. As an alternative, perform safety test according to DIN VDE 0751 Section 1.

4.2 Condition of Front Panel and Case

Check front plate and housing for any damage. Check for function and safety impairments. Check control panel, display, and LEDs for proper function.

4.3 Condition of Cables

Check all cables for damage and proper fit. Any cables suspected of being damaged and/or flawed in any way (e.g., insufficient insulation, breaks, malfunctioning contacts, etc.) must be replaced.

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4.4 Condition of Tubes

Check all tubes for damage and proper fit. Replace any tube(s) suspected of leaking, brittleness, or other damages.

4.5 Condition of Electronics Boards

To preserve the safety of the device, replace any boards showing corrosion or other damage at contact or soldering points.

4.6 Checking the High Pressure Unit HPU

High pressure unit

The high pressure unit includes:

- Gas inlet filter
- High pressure sensor HPS
- High-pressure regulator HPR
- High pressure gas heating HPH
- High pressure safety valve HSV

4.6.1 Checking Gas Supply Connection/Gas Inlet Filter

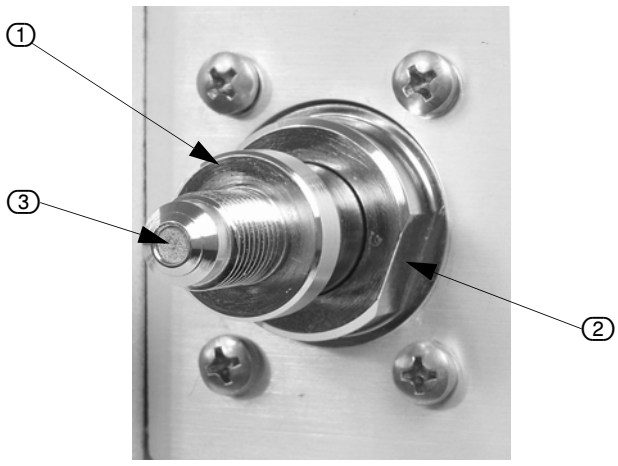
Soiling

The gas inlet filter ③ may be plugged or soiled due to unclean gas or gas supply residues (see Fig. 4-1 Gas supply connection). This type of soiling, however, cannot be detected externally. Heavy soiling is especially noticeable during higher flow rates and results in the actual gas flow falling short of the nominal gas flow during active insufflation. If cleaning the surface of the gas inlet filter does not yield any improvement, the gas supply connection ① must be replaced in its entirety (see chapter 6.1 Uninstalling/Installing Gas Supply Connection).

WARNING!
Make sure to exchange the gas supply connection US with a gas supply connection for house gas when connection to a house gas supply. Otherwise, the device exhibits the behavior described above.

Fig. 4-1 Gas supply connection

① Gas connection US
② Wrench flat WS24
③ Gas inlet filter



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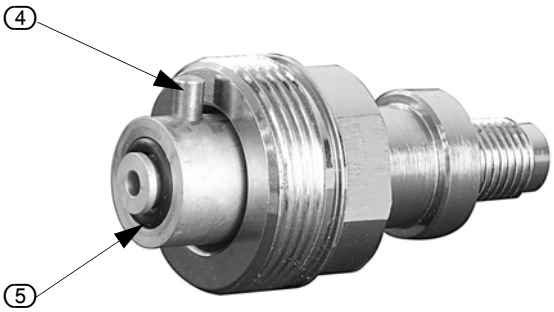

Fig. 4-2 Disassembled gas supply connection

④ Anti-twist stop

⑤ O-ring (seal)

Gas connection seal

The gas supply connection has to be removed in order to be able to check the seal ⑤ (see chapter 6.1 Uninstalling/Installing Gas Supply Connection). When inserting the new gas supply connection, make sure to insert the anti-twist stop ④ properly.

4.6.2 Checking the High Pressure Sensor

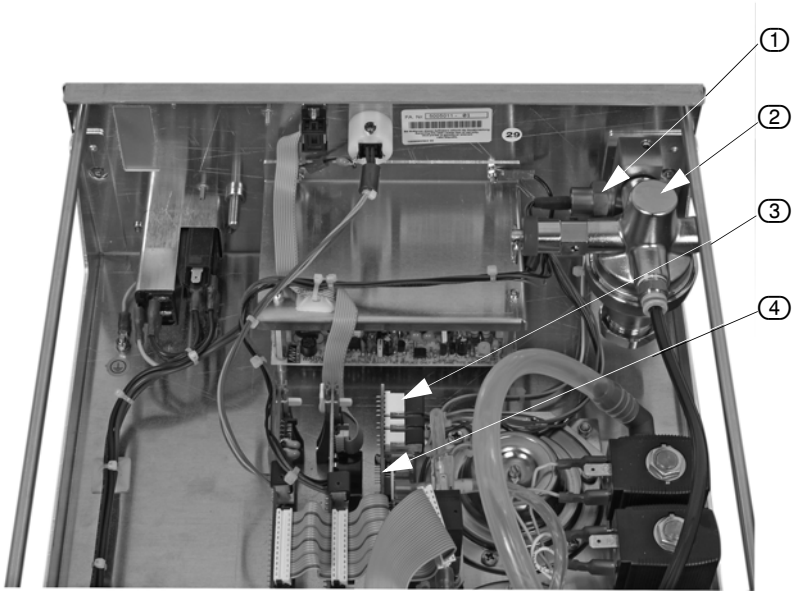

Fig. 4-3 Position of high pressure sensor

① High pressure sensor HPS

② High pressure unit HPU

③ Plug ST3/cable leading to pressure sensor HPS

④ PCU board

Follow these steps to check the function of the high pressure sensor ① (see Fig. 4-3 Position of high pressure sensor):

1. The device is open and switched on. A gas bottle (pressure >50 bar) is connected and open.
2. The gas supply display depicts the maximum supply pressure.
3. While device is switched on and the gas bottle is connected and opened, pull plug ST3/cable ③ of the high pressure sensor off the PCU board ④.
4. In the display, the error message **Check gas supply** must be depicted. The gas supply display depicts a pressure of < 15 bar. Reconnect plug connector ③ with PCU board ④.
5. The test of the high pressure sensor has been completed successfully.

Corrective measure

- If the error message and pressure reading **Pressure <15 bar** are not displayed, the high pressure unit HPU or LPU must be replaced.

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4.6.3 Checking High Pressure Regulator at the HPU

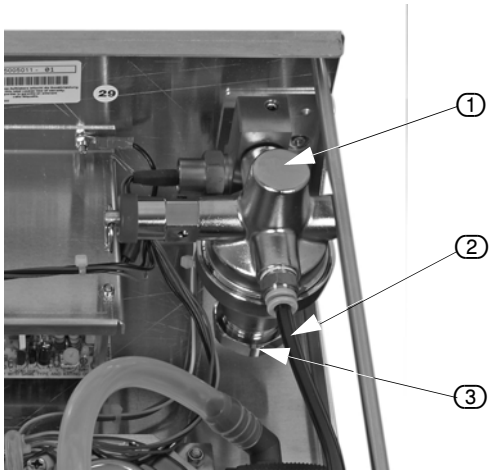

Fig. 4-4 Position of adjustment screw at HPU

① High pressure unit HPU
② High pressure tube HPT
③ Adjustment screw

WARNING!

Discharge the pressure before removing a tube from the HPU.

1. Remove the high pressure tube ② from the HPU outlet (see Fig. 4-5 High pressure unit HPU, press down the plastic ring and pull out tube) and connect a T-adapter with venting valve and 0-7 bar manometer.
2. Connect the device to a gas bottle (pressure > 50 bar) and open the bottle.
3. Relieve pressure of tube at the additionally connected outlet valve.

A stable end value of 1.5 to 2.5 bar must be reached.

NOTE!
The output value drops with an increasing temperature (e.g. long operation time) and has to be adjusted if necessary.

Remove the test equipment and reinsert the high pressure tube ② or continue with chapter 4.6.4 Checking High Pressure Unit HPU for Leaks .

Corrective measure

- Use the adjustment screw ③ at the high pressure regulator in case values deviate from the tolerance range. If this is not possible, the high pressure unit HPU must be replaced.

4.6.4 Checking High Pressure Unit HPU for Leaks

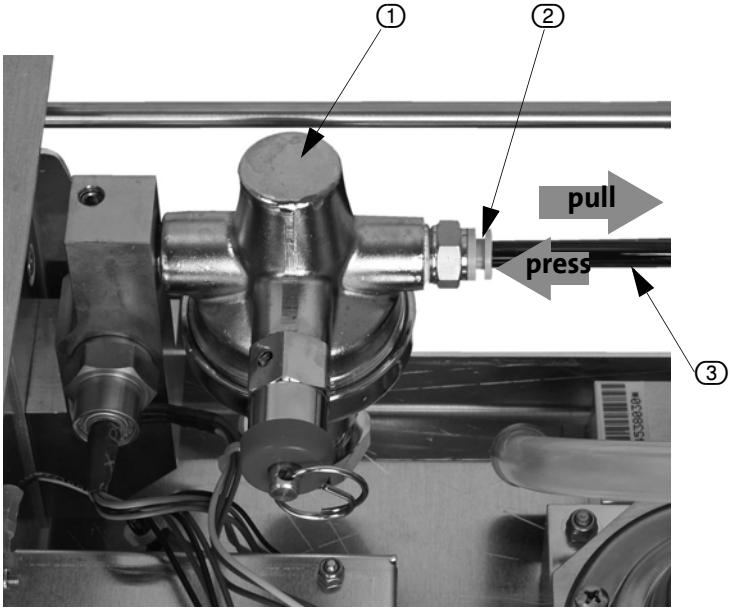

Fig. 4-5 High pressure unit HPU

① High pressure unit HPU
② Plastic ring
③ High pressure tube HPT

1. Connect a gas bottle with 0-100 bar manometer to gas supply connection at rear of device.
2. Remove the high pressure tube ③ from the HPU outlet ① (pinch plastic ring ② and pull out tube ③).
3. Connect a T-adapter with venting valve and 0-7 bar manometer.
4. Briefly open and then re-close the gas bottle.

After 10 minutes, the pressure at the 0-7 bar manometer should not have dropped more than 5 bar.

Corrective measure

- Checking gas supply connection (O-ring).
- Replacing the high pressure unit HPU.

4.6.5 Checking the High Pressure Heating Unit

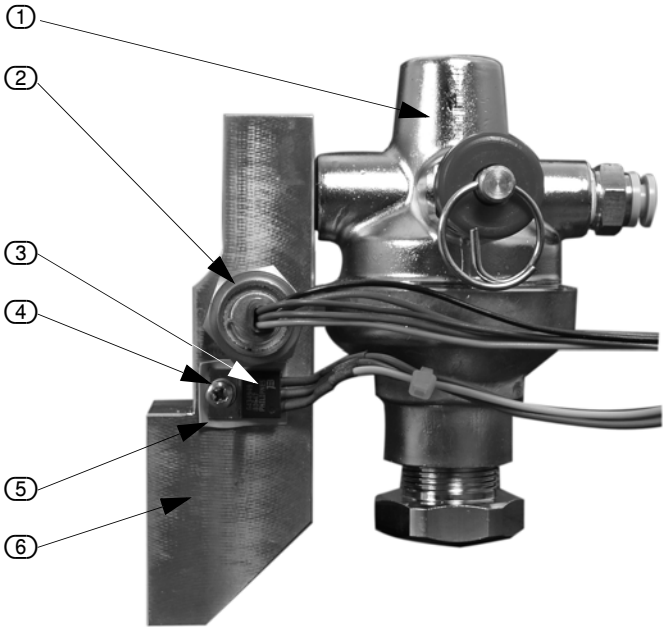

Fig. 4-6 Position of high pressure heating unit HPH

① High pressure unit HPU
② High pressure sensor HPS
③ Heater/temperature sensor
④ Fastening screw with insulating bush
⑤ Insulation/heat conducting foil
⑥ Adapter 01 for HPU (metal block)

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Fig. 4-7 High pressure gas heater connections

⑦ PCU board

⑧ Connection of heater/temperature sensor

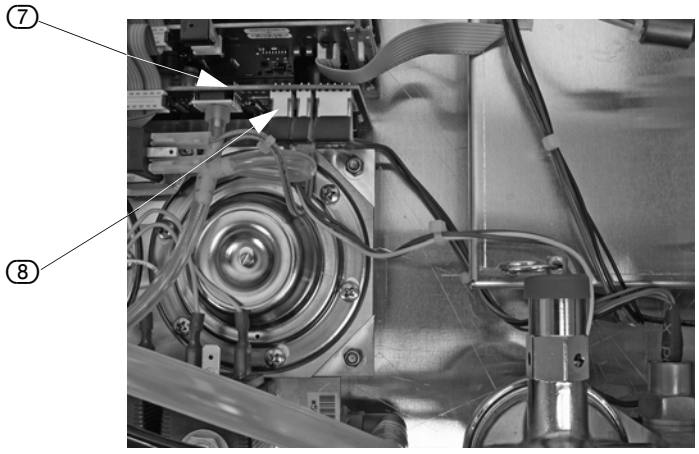


Fig. 4-8 Position of SMD fuse

⑨ SMD super-fast-acting fuse 2A

⑩ PCU board

The high pressure heater is not monitored by the software. Leave the device switched on for approx. 15 minutes. Use your fingers to feel whether the metal block ⑥ (adapter 01 for HPM) has become slightly warm. Fig. 4-6 Position of high pressure heating unit HPH). If the metal block is not warm, check the SMD fuse ⑨ on the PCU board ⑦. The fuse can be removed with a pointed pair of pliers or a pair of tweezers.

DANGER!

Disconnect device from power supply.

Corrective Measure

If the fuse is intact and the block is still not warm to the touch, the heater ③ and/or the LPU have to be replaced (see chapter 6.2.1 Replacing the Heater/Temperature Sensor and chapter 6.3 Uninstalling/Installing Low Pressure Unit LPU). When installing the heater ③, make sure it is placed completely on the insulating foil ⑤. Attach heater ③ with the fastening screw ④ and a plastic insulating bush.

4.6.6 Checking High Pressure Safety Valve HSV at the HPU

Replace the HPU when hearing a continuous hissing sound emitted by the HSV when checking the high pressure regulator (HPR). A short hissing sound after the gas supply is opened for the first time is acceptable.

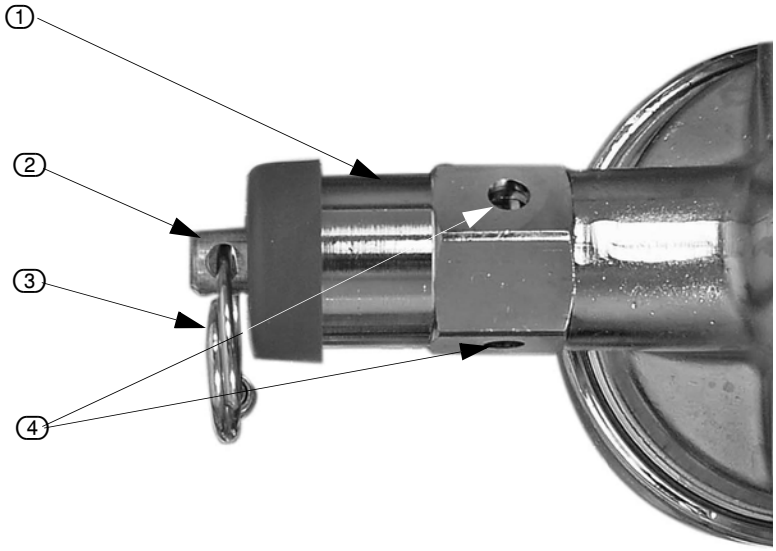


Fig. 4-9 Checking high pressure safety valve HSV at the HPU

1. High pressure safety valve
2. Venting pin
3. Venting ring
4. Drilled holes

1. While pressurized, use the venting ring (3) to remove the venting pin (2) in axial direction up to the stop. A clear hissing sound must be heard.
2. Let the venting pin (2) drop back to its original position. The hissing sound must stop immediately. The movement of the sealing plunger plug of the high pressure fuse (1) is clearly visible through the holes (4) in the spanner flats of the high pressure valve.

Corrective measure

- Replacing the HPU.

4.7 Mounting the Calibration Adapter

The calibrations and tests indicated in the service manual require mounting of a calibration adapter. This adapter consists of a calibration tube with connection plug, a T-adapter with 3-port valve and 2 emerging tubes.

1. Slide plug of the calibration tube into tube connection of the device until locked into place.
2. Turn the Allen screw clockwise using a size 4 Allen wrench up to the stop.
3. Connect the corresponding supplementary equipment to the two emerging tubes in accordance with the respective illustration. Make sure the emerging tube with the larger inner diameter is connected to a flowmeter while the smaller tube is to be connected to a manometer.

EN

4.8 Testing the Low Pressure Unit LPU for Leaks

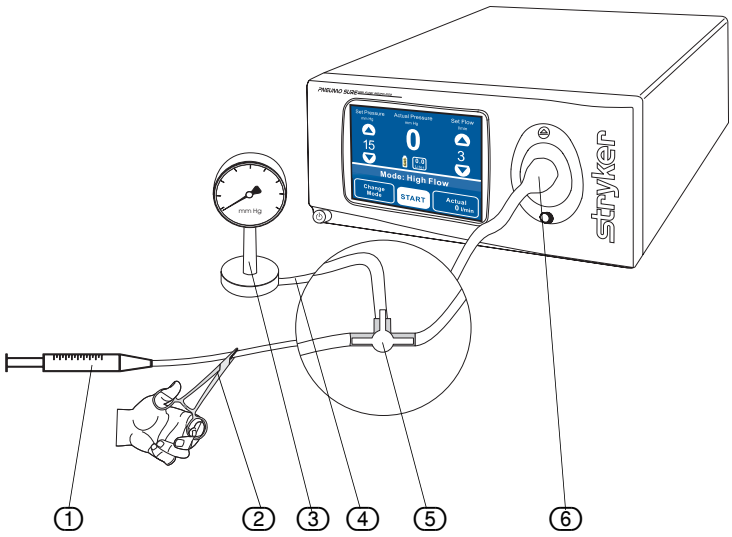


Fig. 4-10 Testing the low pressure unit LPU for leaks

① Syringe
② Tube clamp
③ Manometer 0-100 mm Hg
④ Tube, small diameter
⑤ Three-port valve
⑥ Calibration adapter

1. Switch device off.
2. Attach the calibration adapter ⑤ to the device as described in chapter 4.7 Mounting the Calibration Adapter and turn the 3-port valve ⑤ to the depicted position.
3. Connect a manometer ③ and an air-filled syringe ① to the calibration adapter ⑥.
4. Use the syringe to generate a pressure of 50 mm Hg.
5. Clamp off tube ② at 50 mm Hg using a tube clamp. It is also possible to turn the 3-port valve to the right by 90° instead.

The pressure at the manometer should not have dropped more 2 mm Hg within 30 seconds.

Corrective measure

- Check the calibration adapter for leaks by clamping off the tube leading to the tube connection at the LPU ⑦ using a tube clamp and carrying out a leak test once more. If another leak is detected, check the correct fit of the connection adapter seal and check all tube connections of the adapter including those of the 3-port valve. Replace the LPU if the calibration adapter does not have any leaks. Then repeat the leak test.
- Check the tube at the fluid sensor ⑥ and the low pressure unit LPU ⑦ and replace if necessary (see Fig. 4-11 Position of fluid sensor / low pressure tube LPT).
- Replacing the LPU.

EN

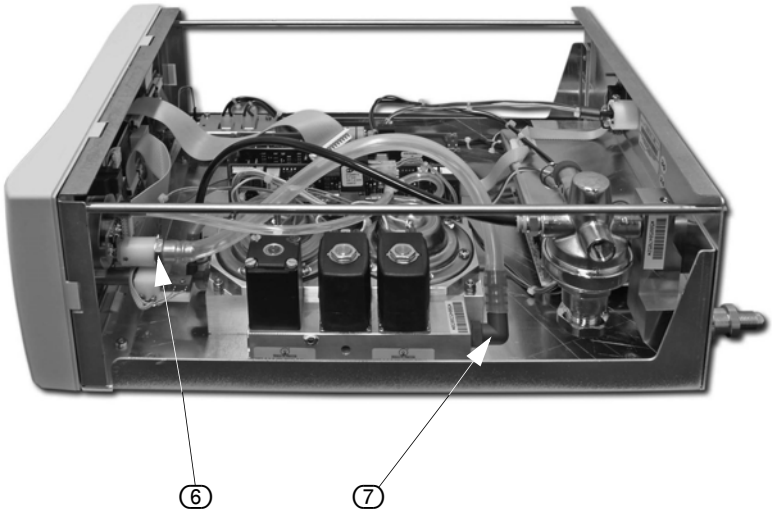


Fig. 4-11 Position of fluid sensor / low pressure tube LPT

(6) Fluid sensor tube connection

(7) Low pressure unit (LPU) tube connection

EN

4.9 Testing the Venting System and Overpressure Alarm

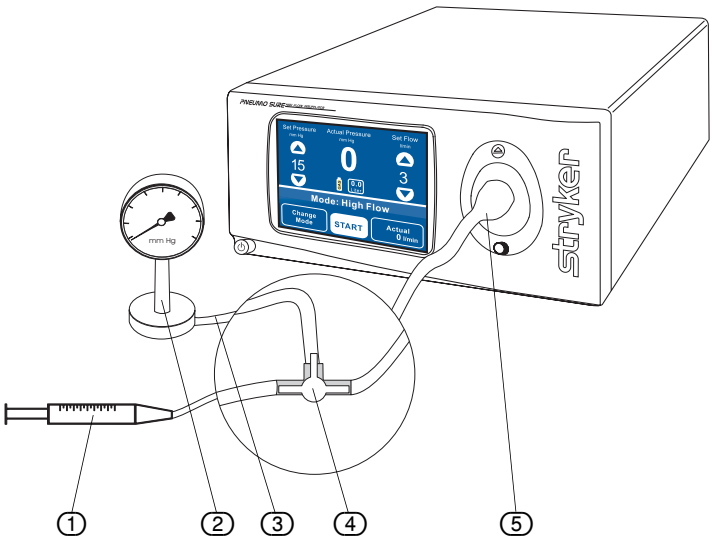


Fig. 4-12 Test setup: Venting system and overpressure alarm

① Syringe
② Manometer 0-100 mm Hg
③ Tube, small diameter
④ Three-port valve
⑤ Calibration adapter

1. Select the following in the configuration menu while in high flow mode: **Venting valve status = OFF with Veress insufflation**.
2. Attach the calibration adapter ⑤ to the device as described in chapter 4.7 Mounting the Calibration Adapter and turn the 3-port valve ④ to the depicted position.
3. Connect a manometer ② and an air-filled syringe ① to the calibration adapter (see Fig. 4-12 Test setup: Venting system and overpressure alarm)
4. Set the following values at the device: Nominal pressure = 15 mm Hg, nominal flow = 3 l/min
5. Use the syringe to slowly generate a pressure of 15 mm Hg.
6. Slowly increase the pressure to 20 mm Hg and then press the START/STOP key.
7. A warning sound is emitted and **Overpressure** is depicted.
8. Set the gas flow to > 5 l/min and the nominal pressure to 21 mm Hg.
9. After max. 5 seconds, the venting system will be activated (depends on the time and pressure threshold set in the user menu).
10. The venting system reduced the pressure.
11. Press the START/STOP key and remove the testing tools and additional measuring equipment.

Corrective measure

- Replacing the low pressure unit LPU.

EN

4.10 Testing the Occlusion Warning

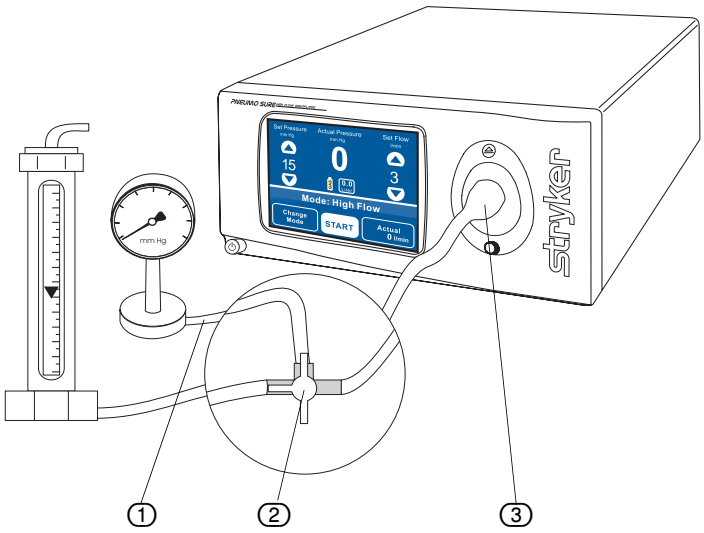


Fig. 4-13 Testing the occlusion warning

① Tube, small diameter
② Three-port valve
③ Calibration adapter

1. In high flow mode, set the nominal pressure = 15 mm Hg and the nominal flow = 3 l/min (see also 4.9 Testing the Venting System and Overpressure Alarm).
2. Attach the calibration adapter ③ to the device as described in chapter 4.7 Mounting the Calibration Adapter and turn the 3-port valve ② to the depicted position.
3. Start insufflation with the START/STOP key.
4. An audible warning signal is emitted and **Occlusion** is depicted (note: The acoustic warning signal can be deactivated in the user menu!)
5. Turn the 3-port valve to the right by 90°. The warnings are deactivated.
6. End insufflation with the START/STOP key.

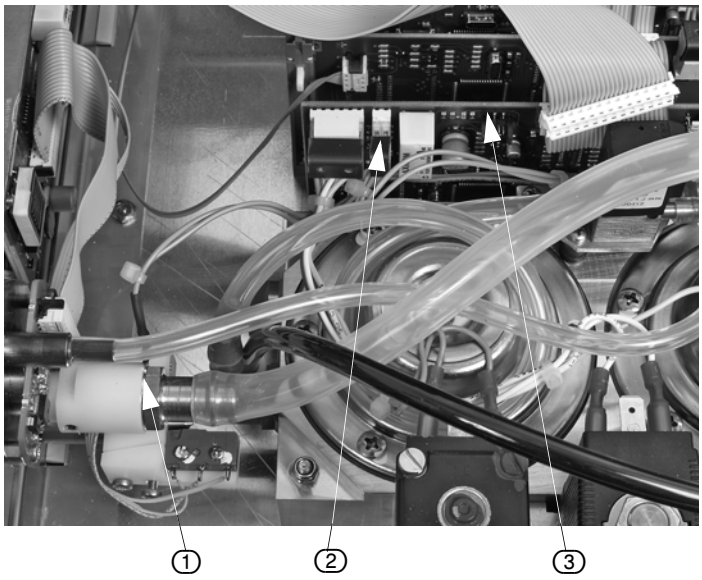
Corrective measure

- Check (for leaks) to make sure the calibration adapter functions properly.
- Replace the LPU.

EN

4.11 Fluid Sensor Test

Fig. 4-14 Position of fluid sensor



① Fluid sensor

② ST6 plug/cable leading to fluid sensor

③ PCU board

1. The device is open and in high flow mode.
2. Remove the ST6 plug ② from the PCU board ③.
3. On the display, the message **Contamination** must be depicted.
4. With each new START/STOP, the message **Contamination** must be displayed.
5. Turn device off and on again. The device has to terminate the self-test with the message **Contamination** (alternating with **Call service)** .
6. Reattach the ST6 plug to the PCU board.
7. Turn device off and on again.
8. Open the service menu of the device and delete the contamination alarm (see chapter 5.14 Deleting Contamination).
9. Turn device off and on again. The contamination alarm must be disabled.

Corrective measure

- If the device does not respond the way described above, the fluid sensor and/ or the low pressure unit LPU must be replaced.

EN

5 Service Menu

Use the service menu to do the following:

Options

- calibrate the device,
- conduct a 12 hr test,
- restore factory settings (factory reset),
- delete contamination warning signal,
- view the software version of the board,
- view the customer version of the board.

Please note the following information:

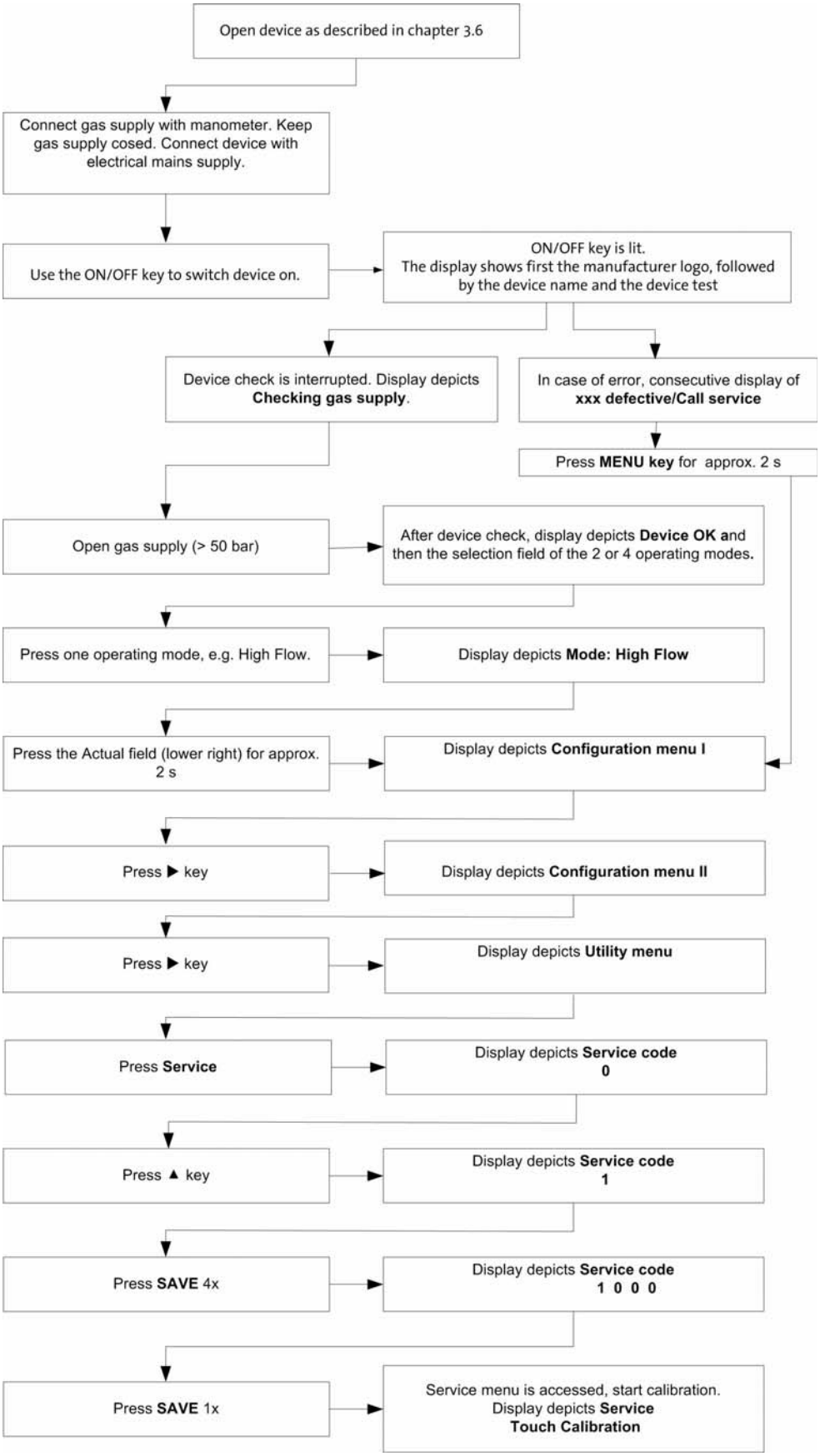
Note

- Input is via the touch display.
- Confirm input by pressing the **SAVE** key.
- A step back or exiting the menu level is carried out with the **EXIT** key.
- When using the calibration adapter, note the mounting instructions as described in chapter 4.7 Mounting the Calibration Adapter .
- Always make sure the 3-port valve is positioned correctly when using the calibration adapter as depicted in the corresponding illustration.
- Always follow the described sequence of steps or the sequence of the service menu when performing calibrations.

The following pages depict the overview flow diagrams.

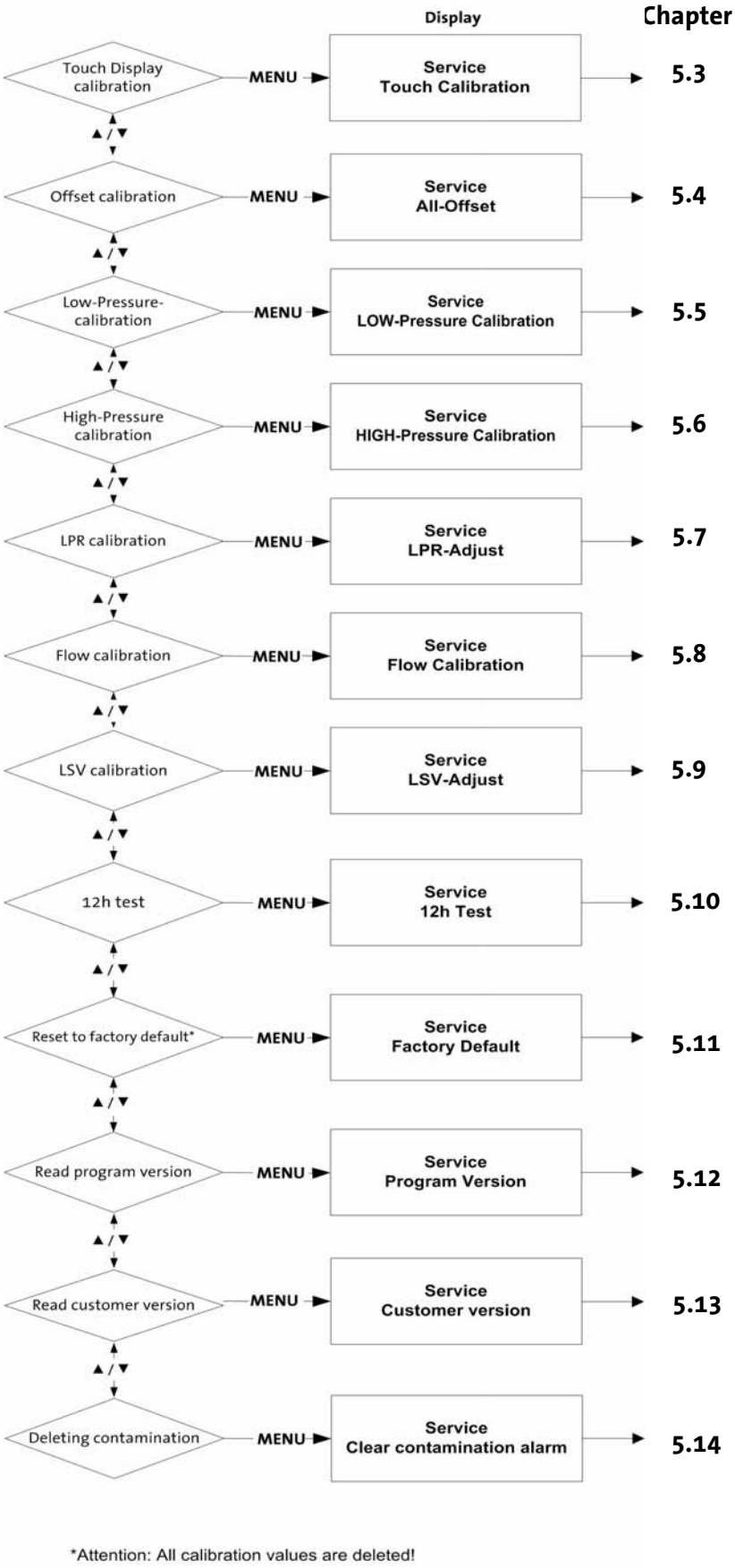
EN

5.1 Service Menu Access


Open device as described in chapter 3.6
Connect gas supply with manometer. Keep gas supply cosed. Connect device with electrical mains supply.
Use the ON/OFF key to switch device on.
ON/OFF key is lit.
The display shows first the manufacturer logo, followed by the device name and the device test
Device check is interrupted. Display depicts **Checking gas supply**.
In case of error, consecutive display of **xxx defective/Call service**
Press **MENU key** for approx. 2 s
Open gas supply (> 50 bar)
After device check, display depicts **Device OK** and then the selection field of the 2 or 4 operating modes.
Press one operating mode, e.g. High Flow.
Display depicts **Mode: High Flow**
Press the Actual field (lower right) for approx. 2 s
Display depicts **Configuration menu I**
Press ▶ key
Display depicts **Configuration menu II**
Press ▶ key
Display depicts **Utility menu**
Press **Service**
Display depicts **Service code 0**
Press ▲ key
Display depicts **Service code 1**
Press **SAVE** 4x
Display depicts **Service code 1 0 0 0**
Press **SAVE** 1x
Service menu is accessed, start calibration.
Display depicts **Service Touch Calibration**

EN

5.2 Service Menu Overview

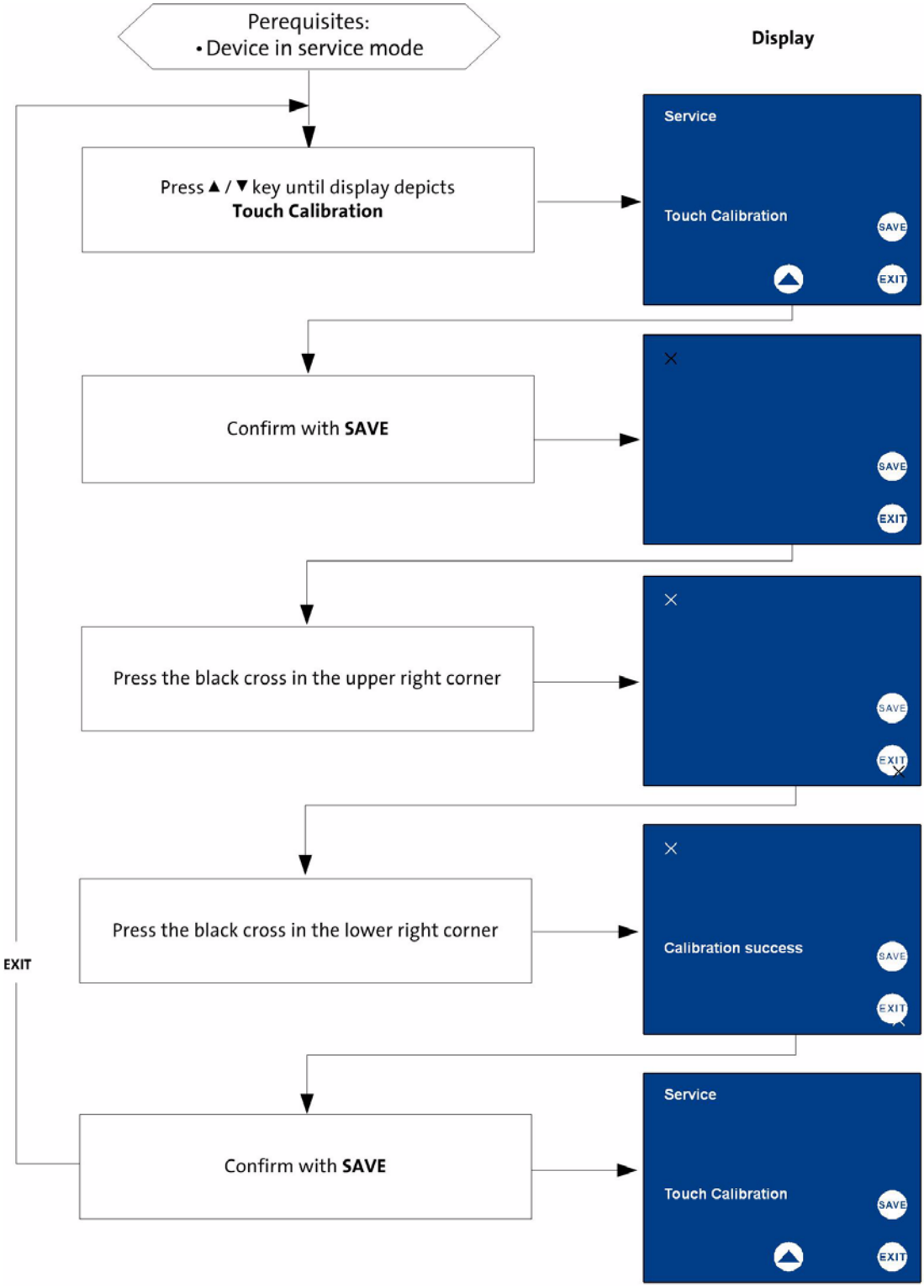


*Attention: All calibration values are deleted!

EN

5.3 Touch Display Calibration

If the touch display must be calibrated (e.g. after replacing the MIO board and/or MIO LCD), initiate the calibration process by touching the touch display anywhere on screen for 2 seconds during the device self-test. Tapping the two black crosshairs on the display (see Fig. below) is part of the calibration process. Confirm the calibration with the **SAVE** key. Please note that the calibration described here is only temporary. The actual calibration must be carried out in the service menu.



EN

5.4 Offset Calibration

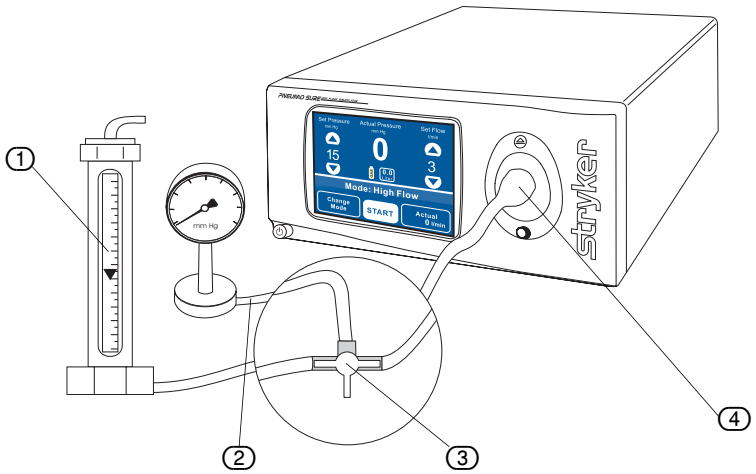
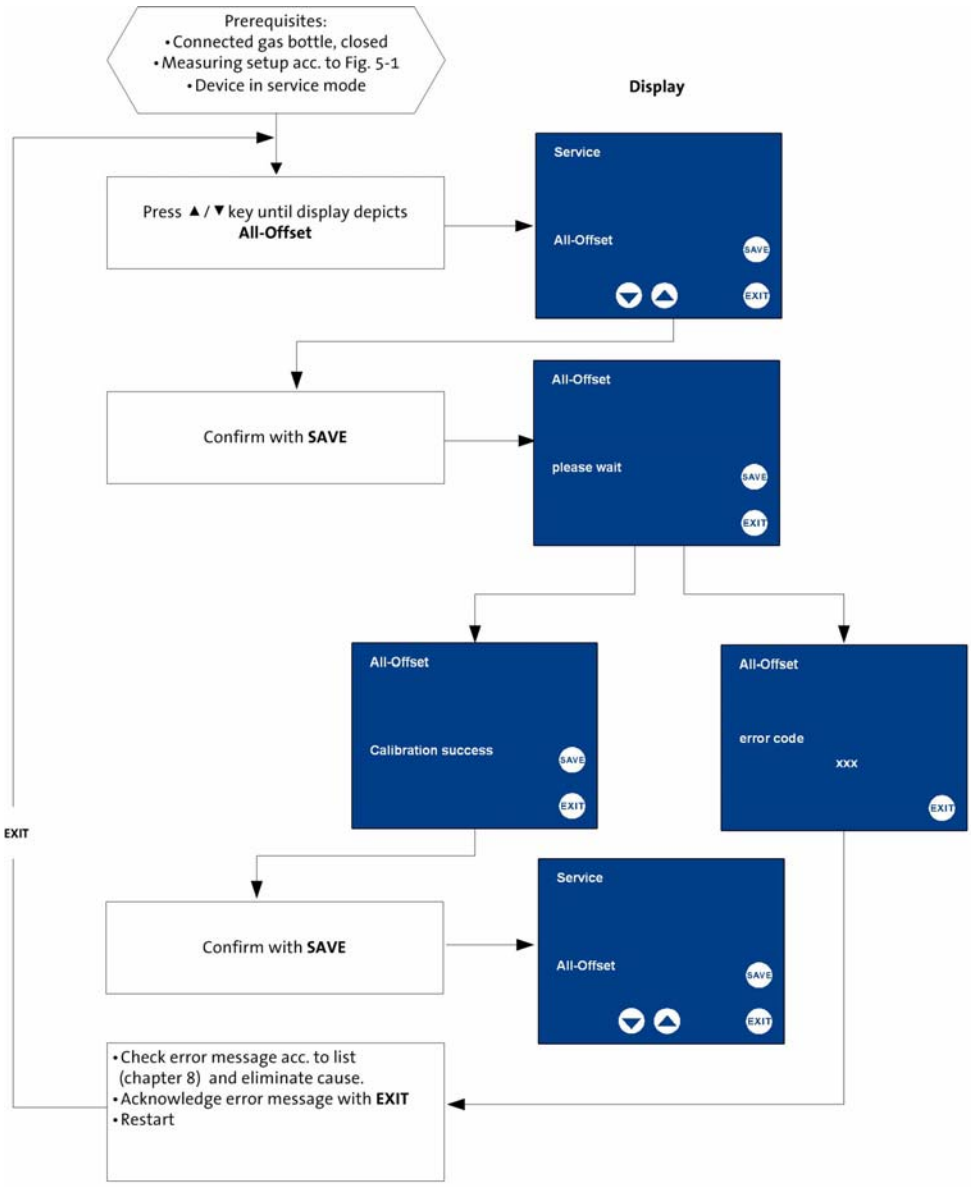


Fig. 5-1 Test setup: Offset calibration

① Flowmeter 0-50 slpm
② Tube, small diameter
③ Three-port valve
④ Calibration adapter

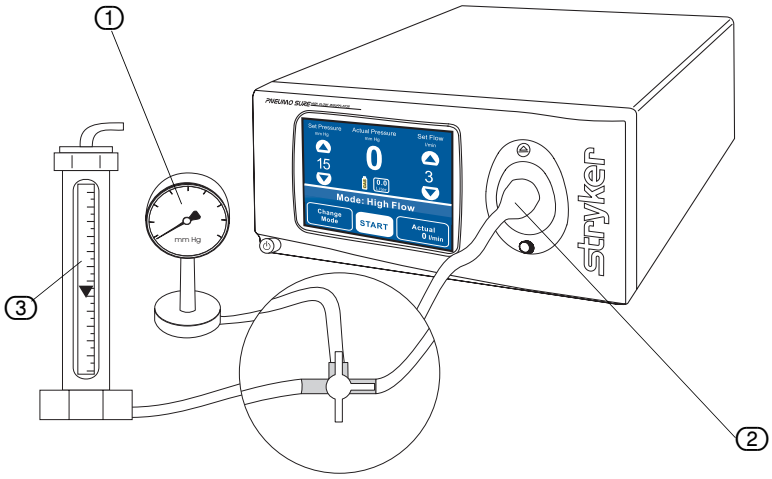


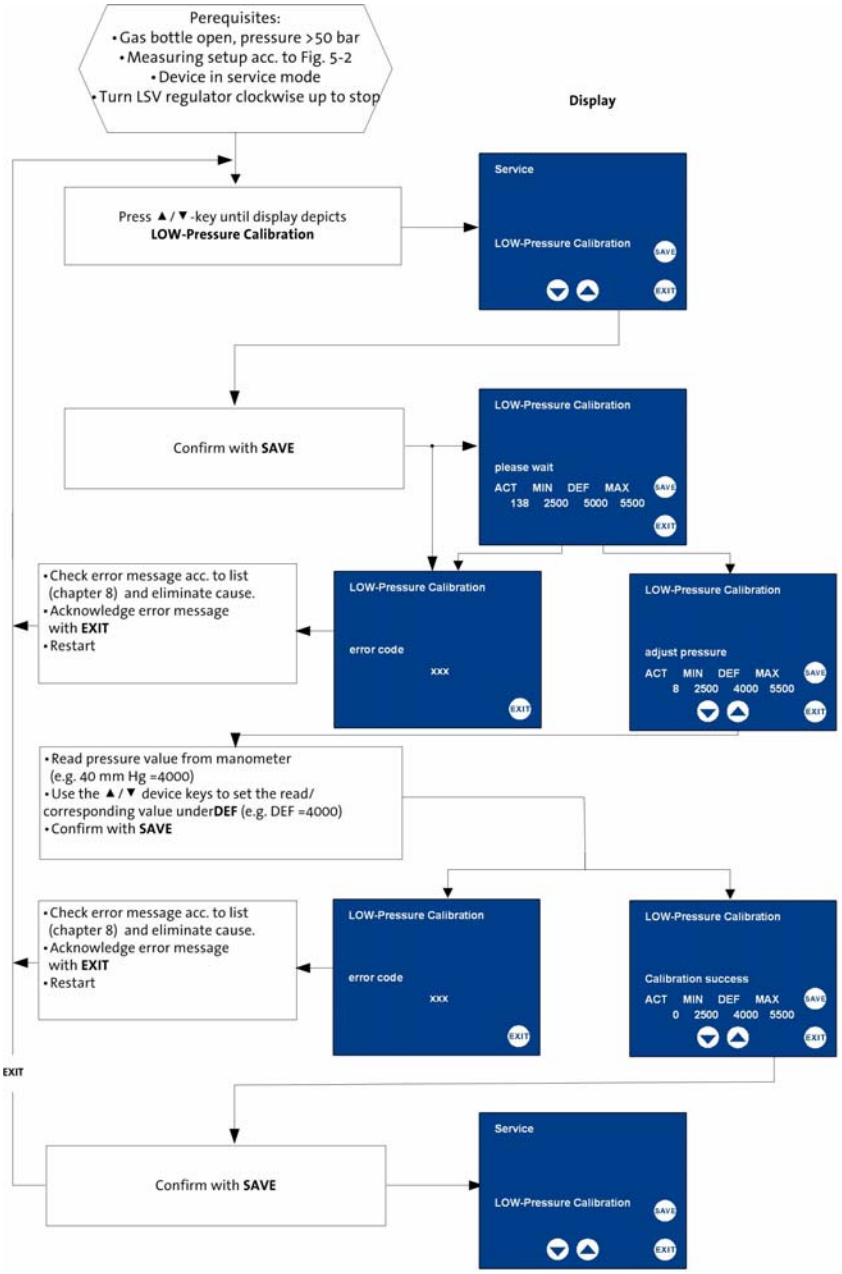
EN

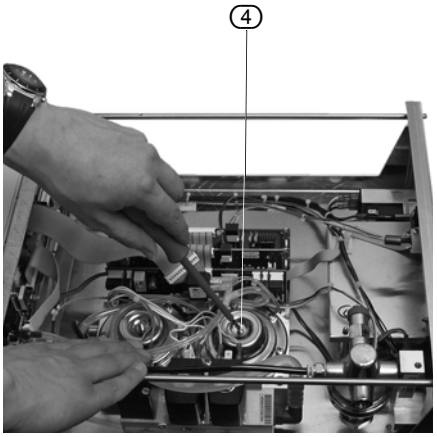
5.5 LOW Pressure Calibration

Fig. 5-2 Test setup: LOW pressure calibration

① Manometer 0-100 mm Hg
② Calibration adapter
③ Flowmeter
④ LSV regulator low pressure safety valve




Perequisites:
• Gas bottle open, pressure >50 bar
• Measuring setup acc. to Fig. 5-2
• Device in service mode
• Turn LSV regulator clockwise up to stop
Display
Press ▲/▼-key until display depicts LOW-Pressure Calibration
Service
LOW-Pressure Calibration
Confirm with SAVE
LOW-Pressure Calibration
please wait
ACT MIN DEF MAX
138 2500 5000 5500
• Check error message acc. to list (chapter 8) and eliminate cause.
• Acknowledge error message with EXIT
• Restart
LOW-Pressure Calibration
error code
xxx
LOW-Pressure Calibration
adjust pressure
ACT MIN DEF MAX
8 2500 4000 5500
• Read pressure value from manometer (e.g. 40 mm Hg =4000)
• Use the ▲/▼ device keys to set the read/ corresponding value underDEF (e.g. DEF =4000)
• Confirm with SAVE
• Check error message acc. to list (chapter 8) and eliminate cause.
• Acknowledge error message with EXIT
• Restart
LOW-Pressure Calibration
error code
xxx
LOW-Pressure Calibration
Calibration success
ACT MIN DEF MAX
0 2500 4000 5500
EXIT
Confirm with SAVE
Service
LOW-Pressure Calibration



EN

5.6 HIGH Pressure Calibration

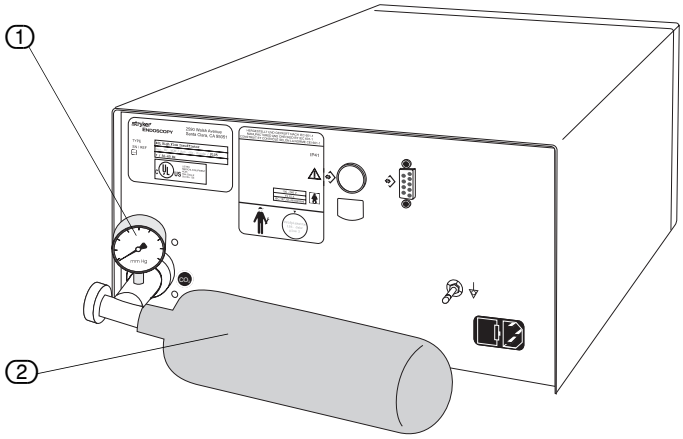
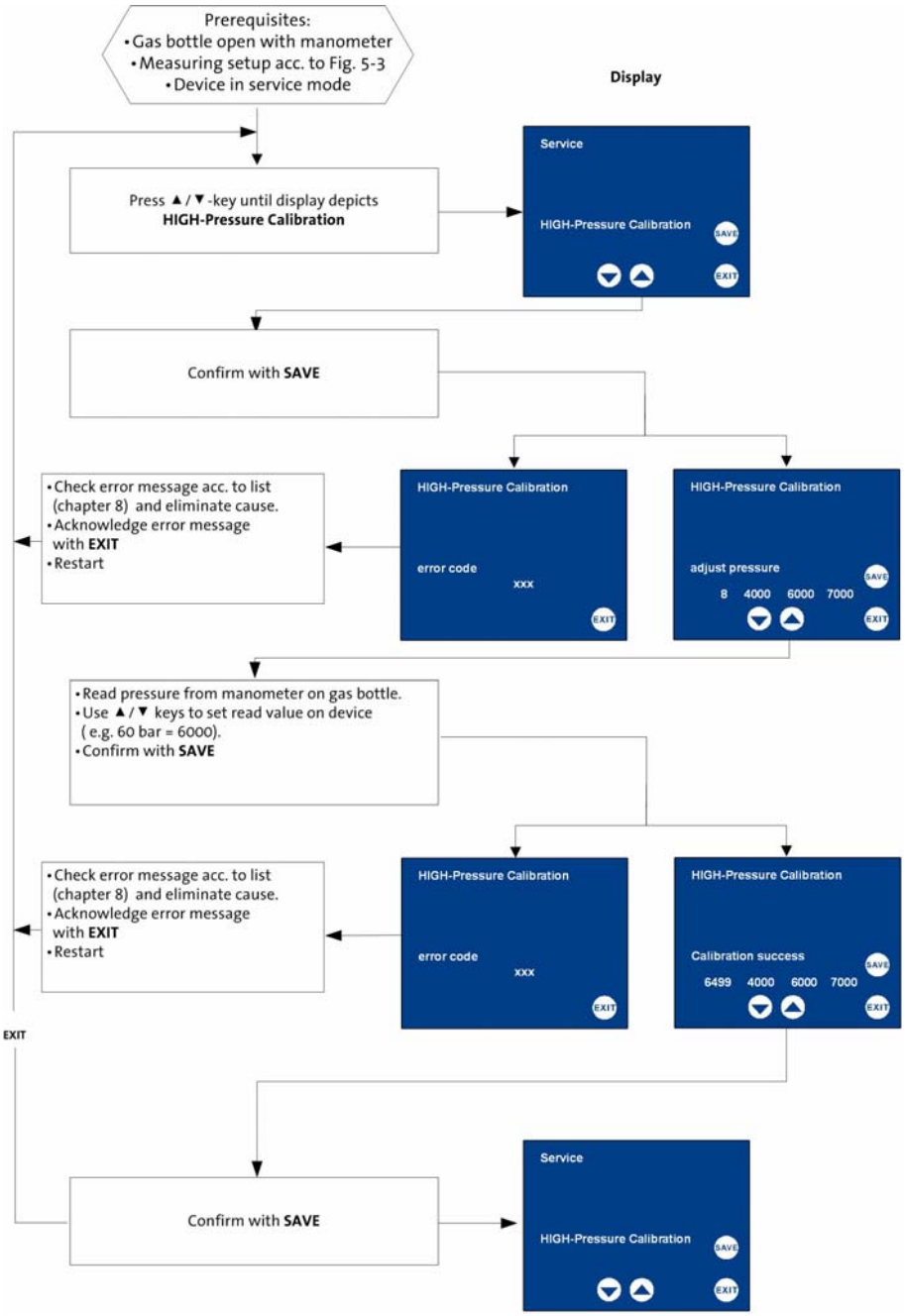


Fig. 5-3 Test setup: HIGH pressure calibration

① Manometer 0-100 bar

② Gas bottle (pressure >50 bar)


Prerequisites:
• Gas bottle open with manometer
• Measuring setup acc. to Fig. 5-3
• Device in service mode
Display
Press ▲ / ▼ -key until display depicts
HIGH-Pressure Calibration
Service
HIGH-Pressure Calibration
SAVE
EXIT
Confirm with SAVE
• Check error message acc. to list (chapter 8) and eliminate cause.
• Acknowledge error message with EXIT
• Restart
HIGH-Pressure Calibration
error code
xxx
HIGH-Pressure Calibration
adjust pressure
8 4000 6000 7000
• Read pressure from manometer on gas bottle.
• Use ▲ / ▼ keys to set read value on device (e.g. 60 bar = 6000).
• Confirm with SAVE
Calibration success
6499 4000 6000 7000
EXIT
Confirm with SAVE

EN

5.7 LPR Calibration

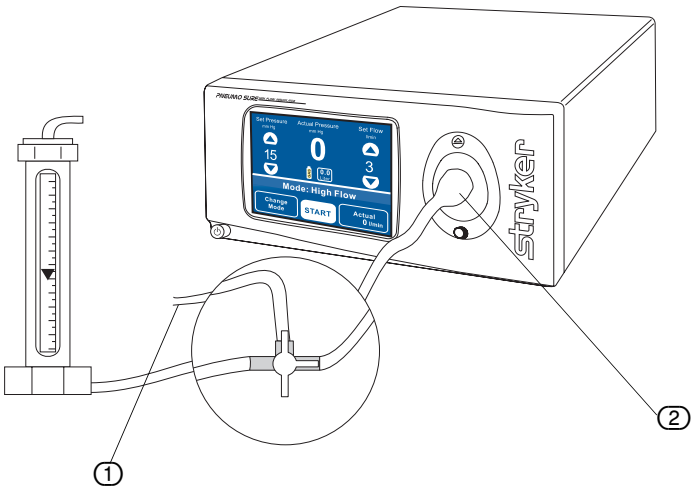
Fig. 5-4 Setting of low pressure regulator LPR

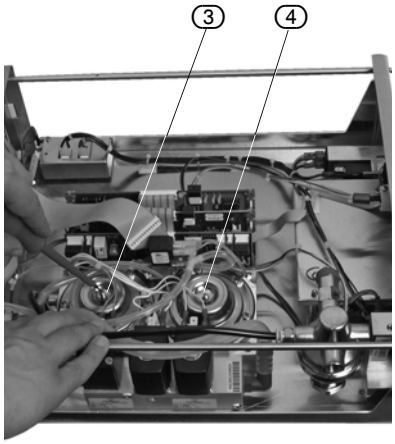
① Open tube end (tube with small diameter)

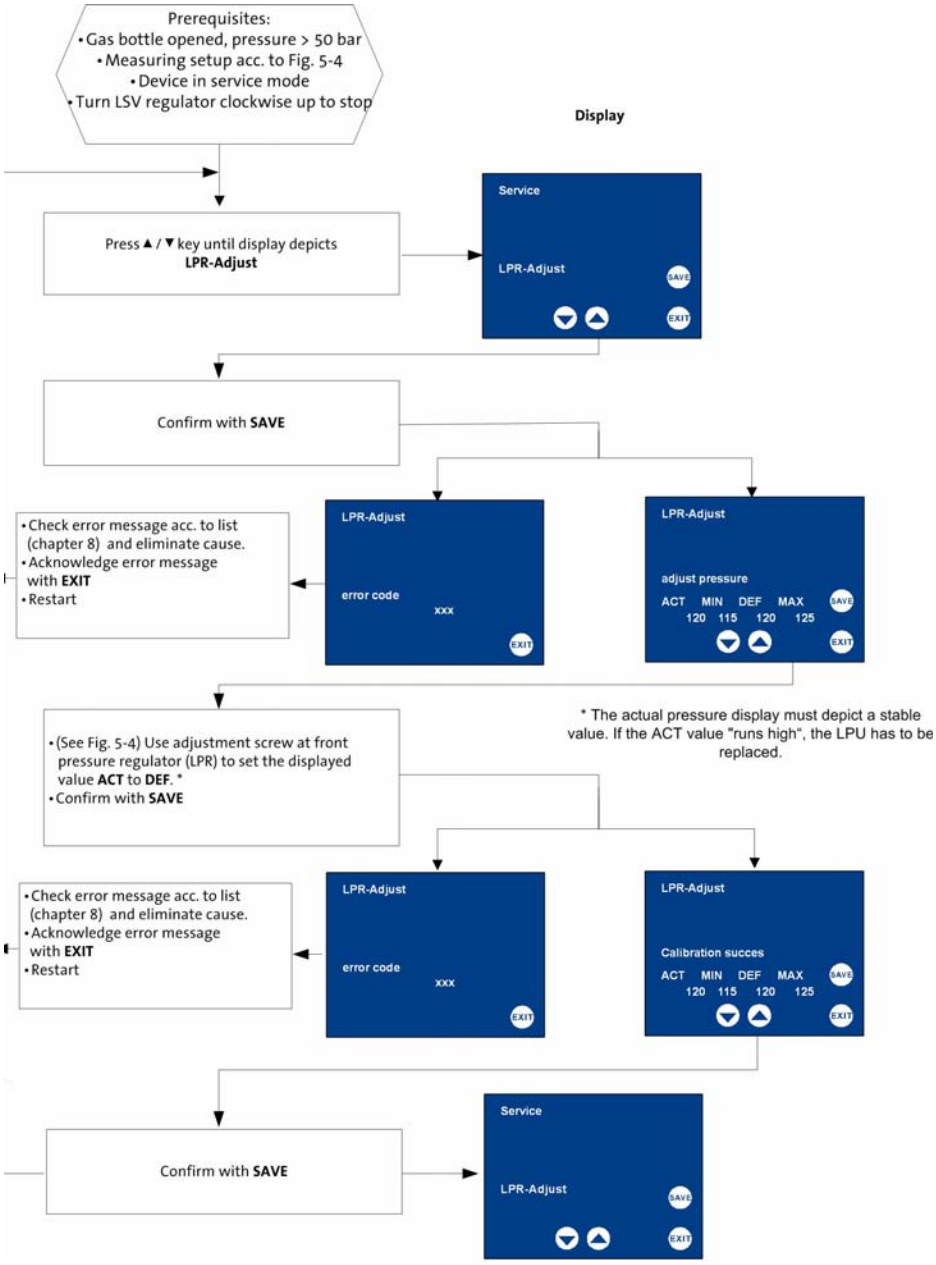
② Calibration adapter

③ LPR regulator

④ LSV regulator






Prerequisites:
• Gas bottle opened, pressure > 50 bar
• Measuring setup acc. to Fig. 5-4
• Device in service mode
• Turn LSV regulator clockwise up to stop
Display
Press ▲ / ▼ key until display depicts LPR-Adjust
Service
LPR-Adjust
SAVE
EXIT
Confirm with SAVE
• Check error message acc. to list (chapter 8) and eliminate cause.
• Acknowledge error message with EXIT
• Restart
LPR-Adjust
error code
xxx
LPR-Adjust
adjust pressure
ACT MIN DEF MAX
120 115 120 125
* The actual pressure display must depict a stable value. If the ACT value "runs high", the LPU has to be replaced.
• (See Fig. 5-4) Use adjustment screw at front pressure regulator (LPR) to set the displayed value ACT to DEF. *
• Confirm with SAVE
• Check error message acc. to list (chapter 8) and eliminate cause.
• Acknowledge error message with EXIT
• Restart
LPR-Adjust
error code
xxx
LPR-Adjust
Calibration succes
ACT MIN DEF MAX
120 115 120 125
Confirm with SAVE
Service
LPR-Adjust
SAVE
EXIT

EN

5.8 Flow Calibration

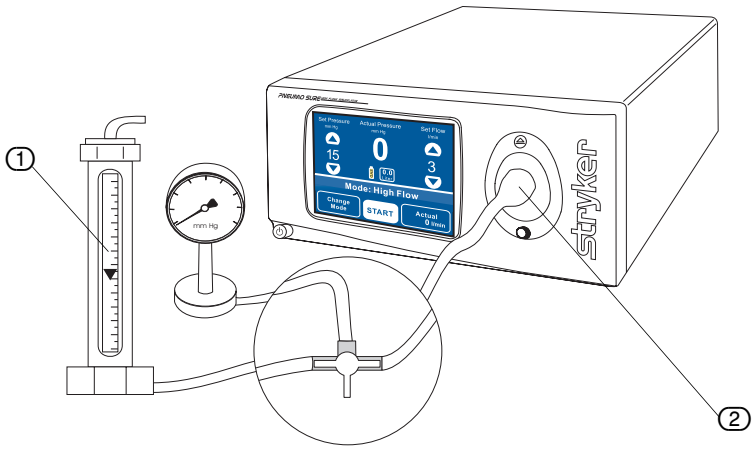
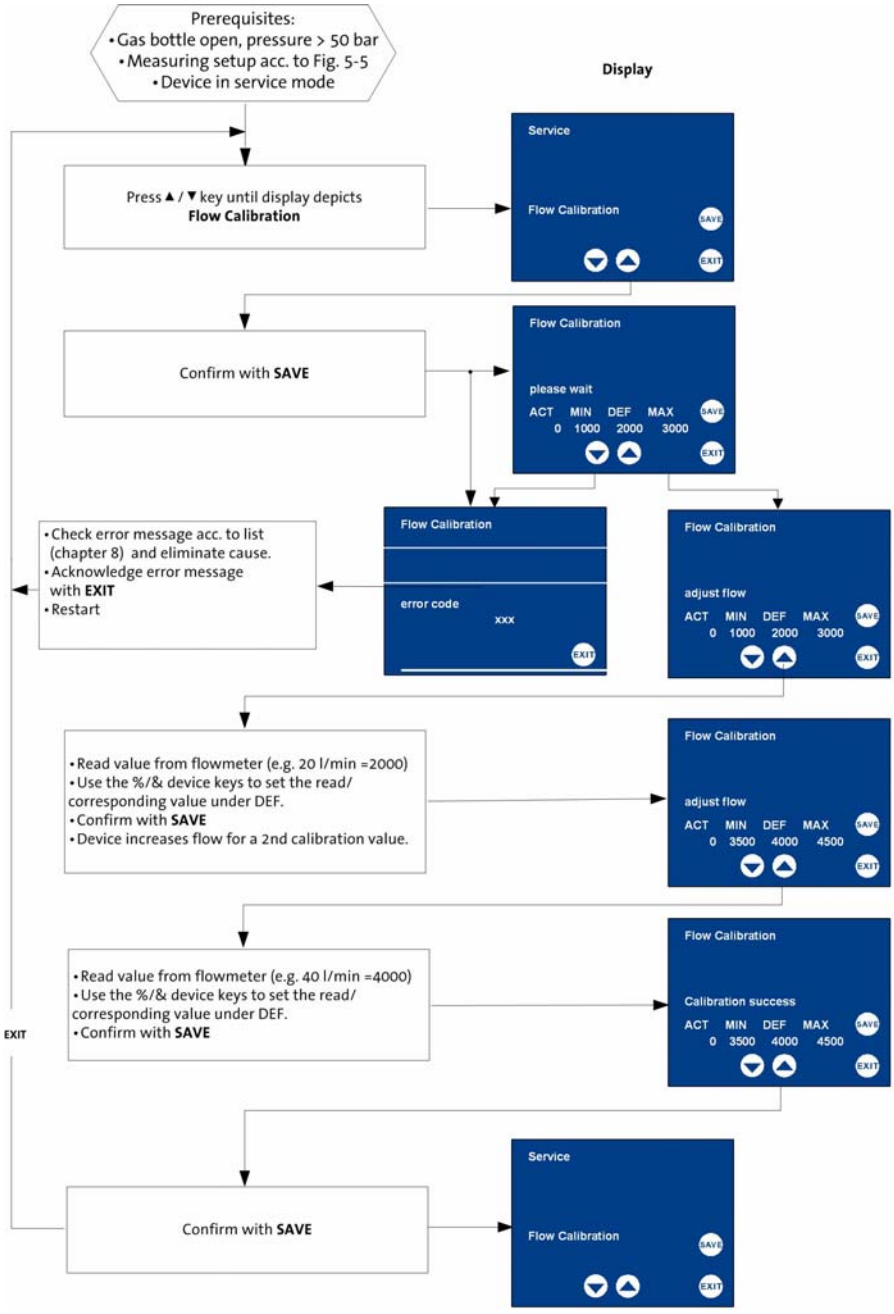


Fig. 5-5 Test setup: Flow calibration

① Flowmeter 0-50 slpm

② Calibration adapter


Prerequisites:
• Gas bottle open, pressure > 50 bar
• Measuring setup acc. to Fig. 5-5
• Device in service mode
Display
Press ▲ / ▼ key until display depicts **Flow Calibration**
Service
Flow Calibration
Confirm with **SAVE**
Flow Calibration
please wait
ACT MIN DEF MAX
0 1000 2000 3000
• Check error message acc. to list (chapter 8) and eliminate cause.
• Acknowledge error message with **EXIT**
• Restart
Flow Calibration
error code
xxx
Flow Calibration
adjust flow
ACT MIN DEF MAX
0 1000 2000 3000
• Read value from flowmeter (e.g. 20 l/min =2000)
• Use the %/& device keys to set the read/ corresponding value under DEF.
• Confirm with **SAVE**
• Device increases flow for a 2nd calibration value.
Flow Calibration
adjust flow
ACT MIN DEF MAX
0 3500 4000 4500
• Read value from flowmeter (e.g. 40 l/min =4000)
• Use the %/& device keys to set the read/ corresponding value under DEF.
• Confirm with **SAVE**
Flow Calibration
Calibration success
ACT MIN DEF MAX
0 3500 4000 4500
EXIT
Confirm with **SAVE**
Service
Flow Calibration

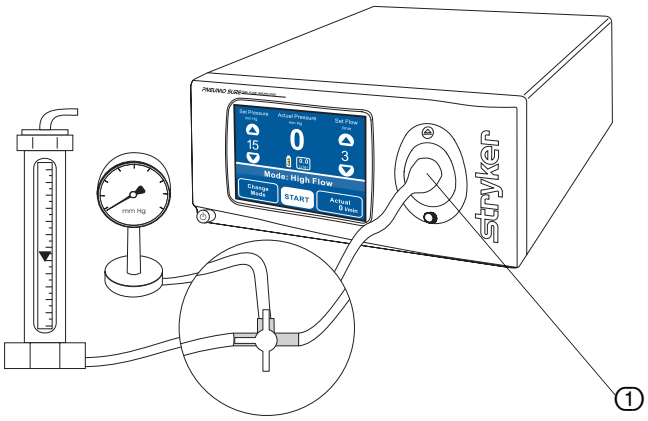
EN

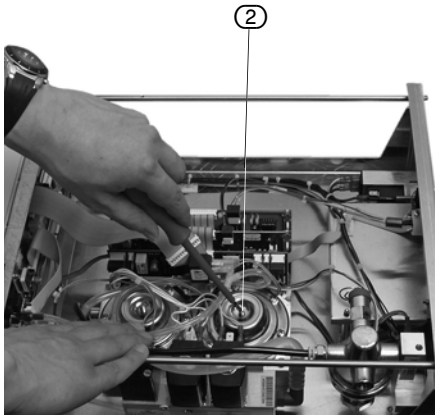
5.9 LSV Calibration

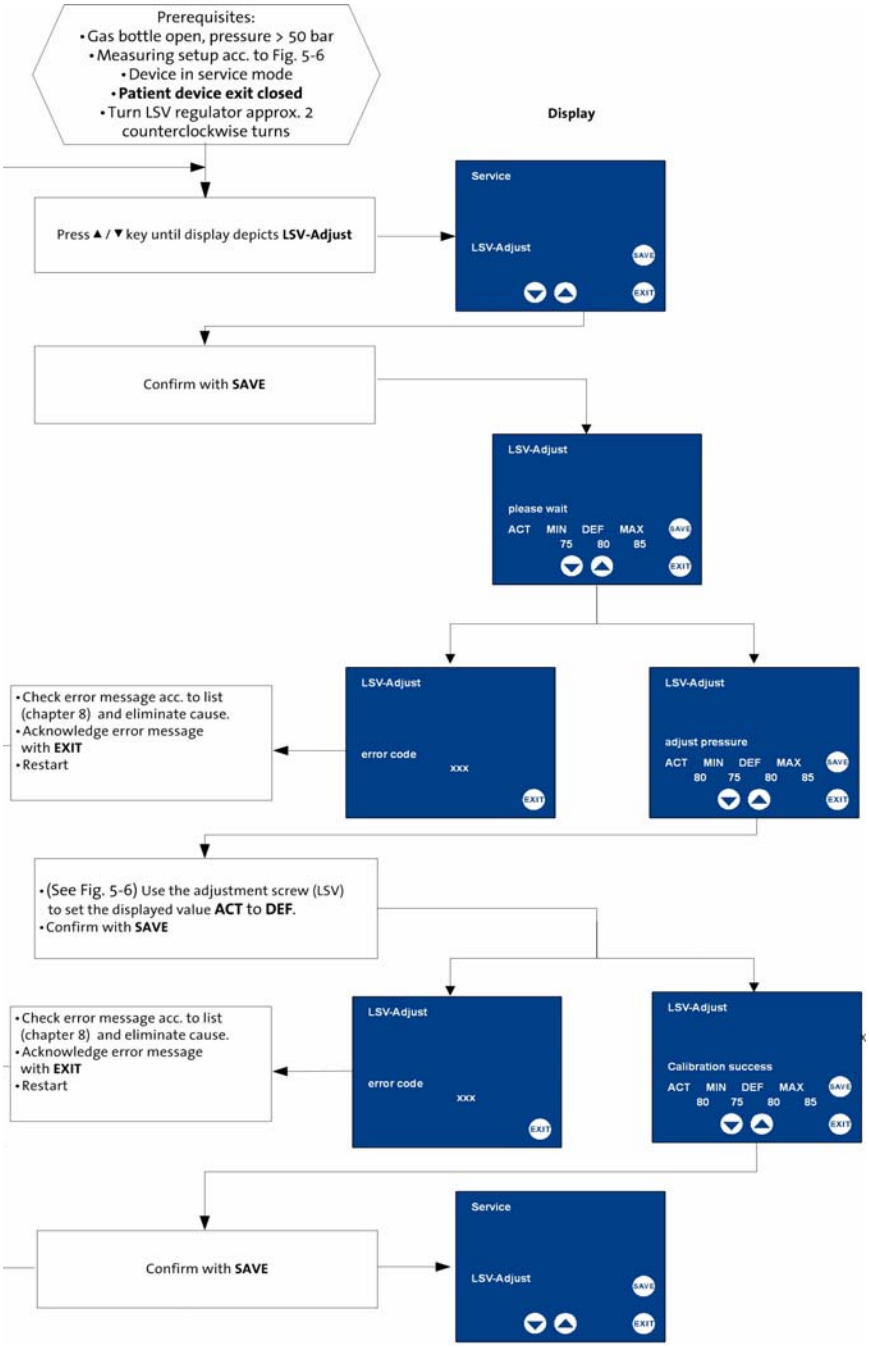
Fig. 5-6 Test setup: Low pressure safety valve LSV

① Calibration adapter

② LSV regulator



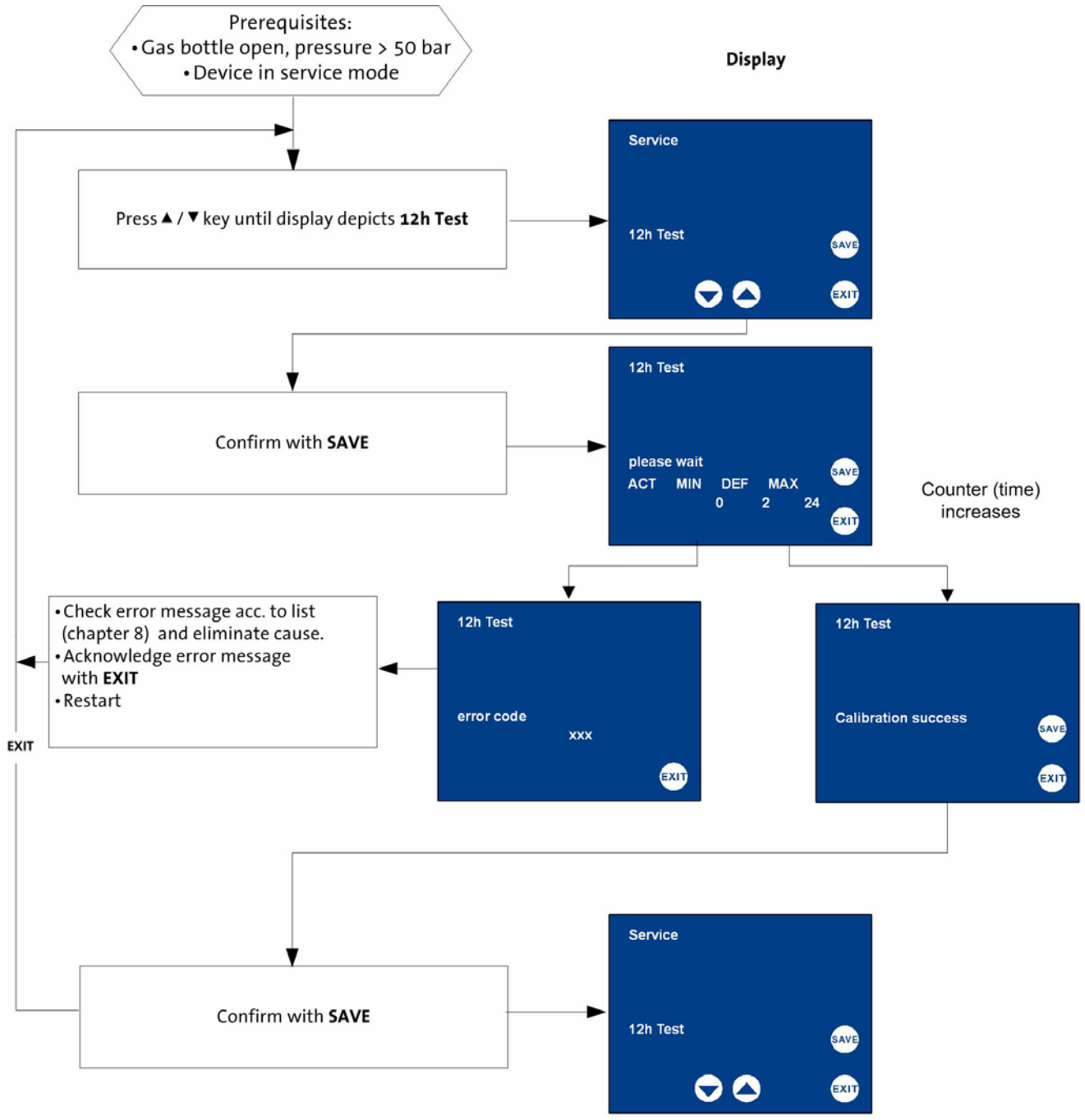




EN

5.10 12-hr Test

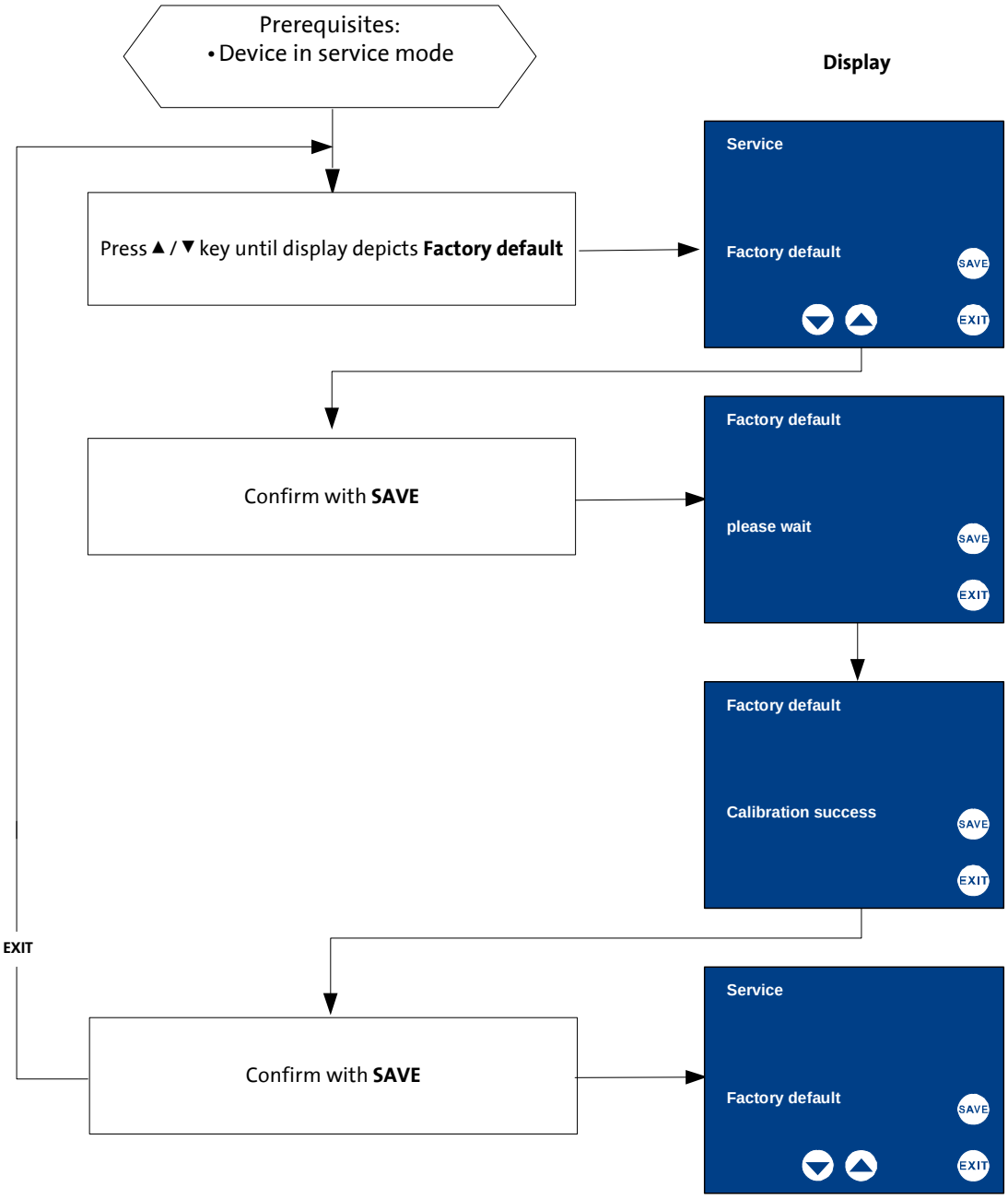
This menu option does not have to be selected in order to calibrate or service the device. When conducting the 12-hr test, make sure the device is continuously connected to a hot power supply and is not used or operated otherwise. Switch device off and on again after completing the 12-hr test.



EN

5.11 Resetting to Factory Defaults

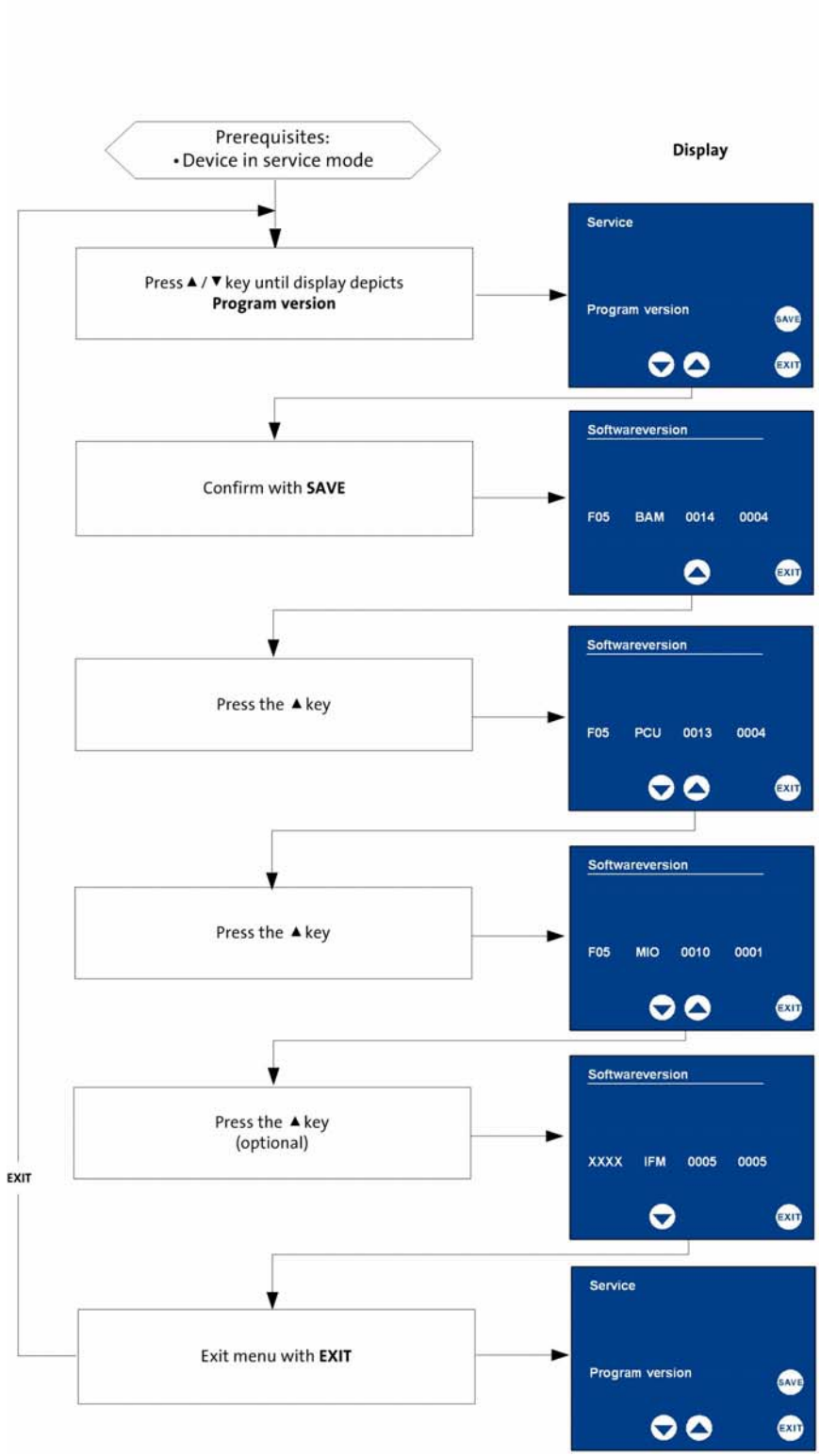
This menu option must only be selected if the device is so severely mis-calibrated that a correct calibration is no longer possible. Please note that selecting this menu option will restore all factory settings. The device is then **not** calibrated and cannot be used until recalibrated.



EN

5.12 Viewing Program Version

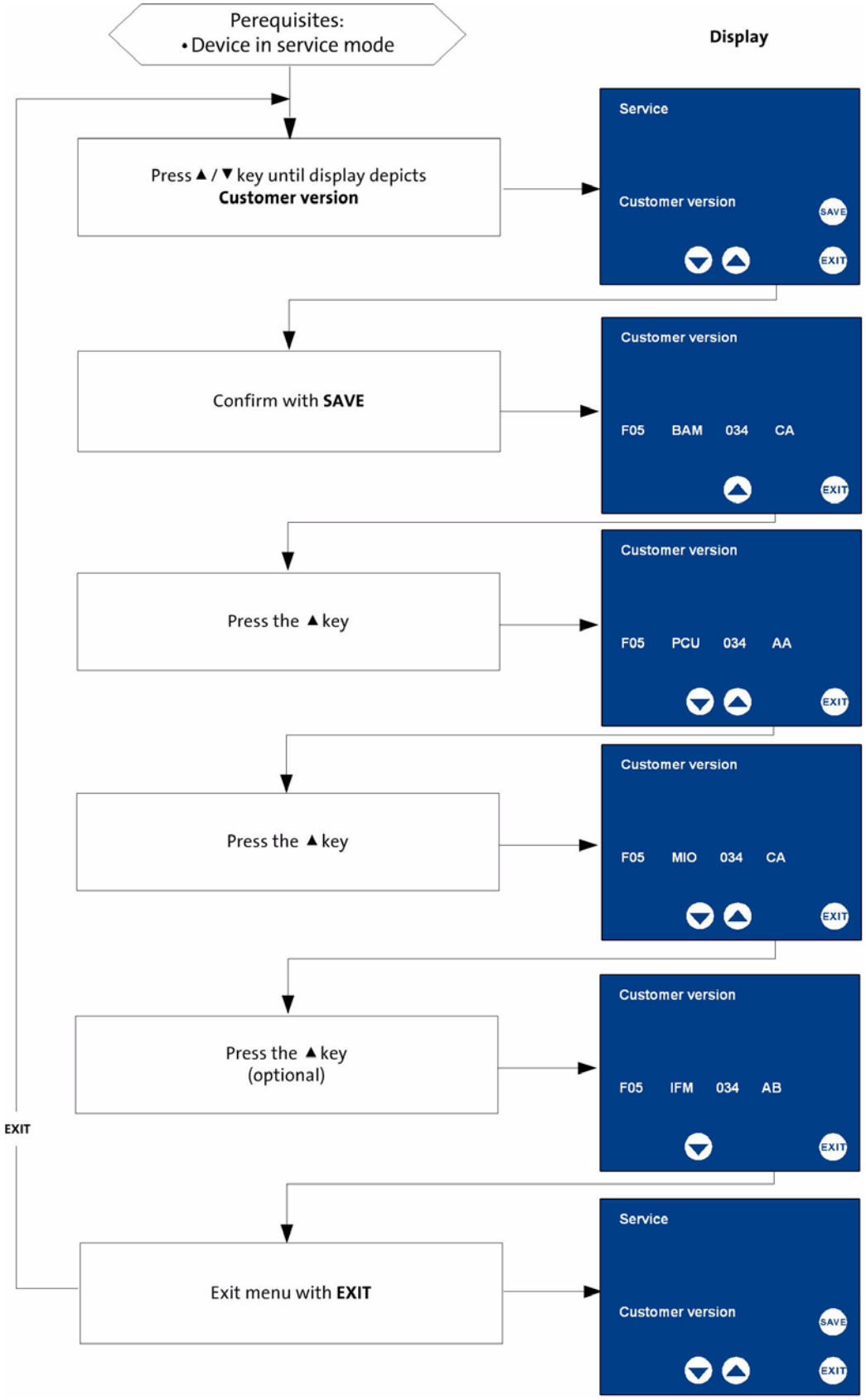
Use this menu option also to view the current software versions of the BAM, PCU, MIO, and IFM boards (optional).



EN

5.13 Viewing Customer Version

Use this menu option to view the current customer versions of the BAM, PCU, MIO, and IFM boards (optional).



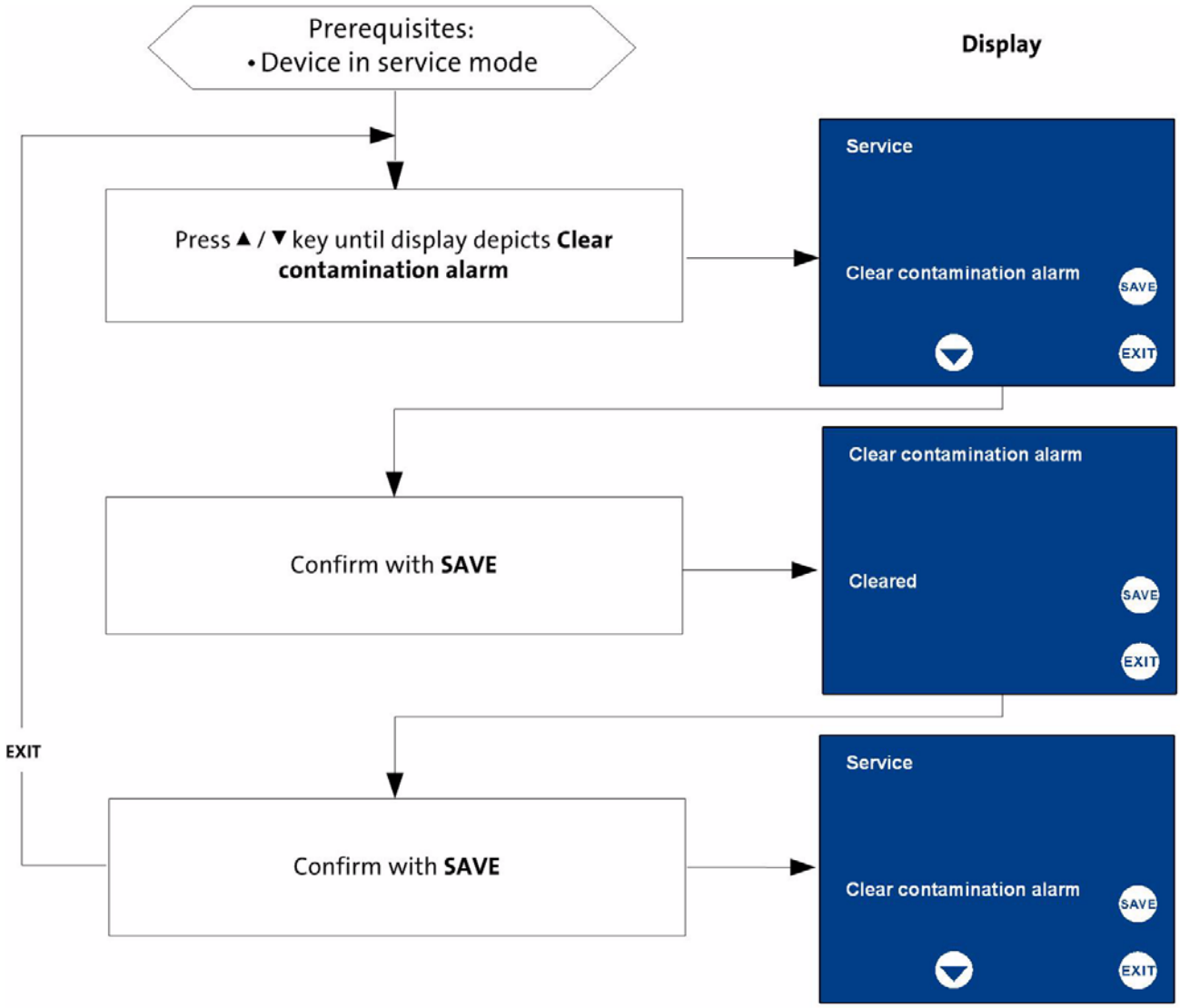
EN

5.14 Deleting Contamination

This menu option does not have to be selected in order to calibrate the device but serves only to cancel a contamination alarm after a device contamination or after testing the contamination alarm. Please note: the device must be restarted after deleting the contamination alarm.

WARNING!
Canceling a contamination alarm is only permissible if this alarm was triggered by an erroneous manipulation or during service or maintenance tasks (e.g., by pulling a plug or during cleaning). The contamination alarm is not canceled until after the device has been restarted. If the contamination alarm was triggered while using the device with a patient, it is not permissible only to cancel the contamination alarm. In this case, the entire LPU must be replaced.

EN


Prerequisites:
• Device in service mode
Display
Press ▲ / ▼ key until display depicts **Clear contamination alarm**
Service
Clear contamination alarm
SAVE
EXIT
Confirm with **SAVE**
Clear contamination alarm
Cleared
SAVE
EXIT
EXIT
Confirm with **SAVE**
Service
Clear contamination alarm
SAVE
EXIT

EN

6 Replacing Components and Modules

DANGER!
Always use an antistatic (ESD) mat and cuff when replacing electronic modules, components, or parts.

Replace a module or component immediately if device tests reveal a defect or if you are unsure whether a component or module is functioning properly.

Components and modules

A list of available spare parts is included in chapter 7 Spare Parts List, page 67. The following describes how to replace these components. Always perform all safety and function tests after replacing a component or part.

The following components/modules can be replaced in case of a defect:

- Fluid sensor (complete)
- Gas connection USA
- Case lid
- Lower part of case incl. device pads
- Pneumo Sure front
- High pressure unit HPU (complete)
- Heater/temperature sensor for for high pressure unit (component)
- Insufflator Pneumo Sure set of cables (complete)
- Mains socket with fuse holder
- Mains switch
- Power supply unit (complete)
- Low pressure unit LPU04
- IFM board/ SIDNE interface
- BAM03 board (basic module)
- MIO board
- MIO LCD board
- HPL board (heater board)
- NET board
- Potential equalization plug
- Tube detection
- Insufflator Pneumo Sure set of tubes
- Snap lock
- Tube connection
- SMD super-fast-acting fuse 2A
- Display touch panel
- PPV valve

EN

6.1 Uninstalling/Installing Gas Supply Connection

Fig. 6-1 Position of gas supply connection

① Gas supply connection

Fig. 6-2 Detail A: Gas supply connection

② 4x fastening screws

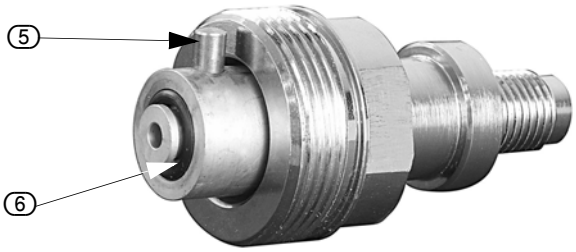
③ Wrench flat WS24

④ Gas inlet filter (sintered metal)

Fig. 6-3 Gas supply connection (disassembled)

⑤ Anti-twist stop

⑥ O-ring (seal)



The gas connection consists of the following:

Supply-specific connection adapter completely mounted with:

- Gas inlet filter (sintered metal filter) ④
- Screw connection SW24 ③
- O-ring at face surface ⑥

The component has to be replaced in case of defective, leaking pressure joints, flow-diminishing filter deposits, and as necessary due to the specific application. The sintered metal filter is pressed in and can only be replaced together with the gas connection.

1. Use a SW 24 fork wrench to loosen the screw connection (3).
2. Make sure the O-ring remains in place when removing the component (6).

NOTE!
When inserting the new gas supply connection, make sure to insert the anti-twist stop (5) properly!

6.2 Uninstalling/Installing High Pressure Unit HPU

The gas connection is connected with the high pressure unit. The high pressure unit consists of the following function elements:

- High pressure regulator
- High pressure safety valve
- High pressure sensor
- Heater/temperature sensor

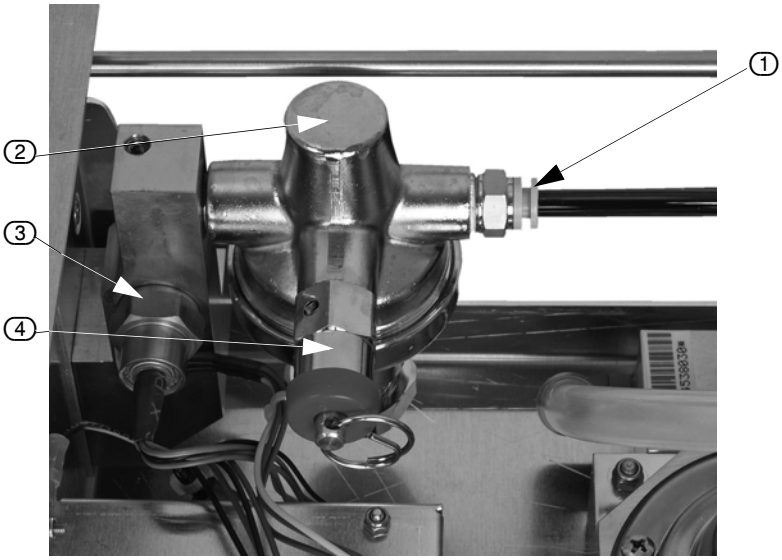


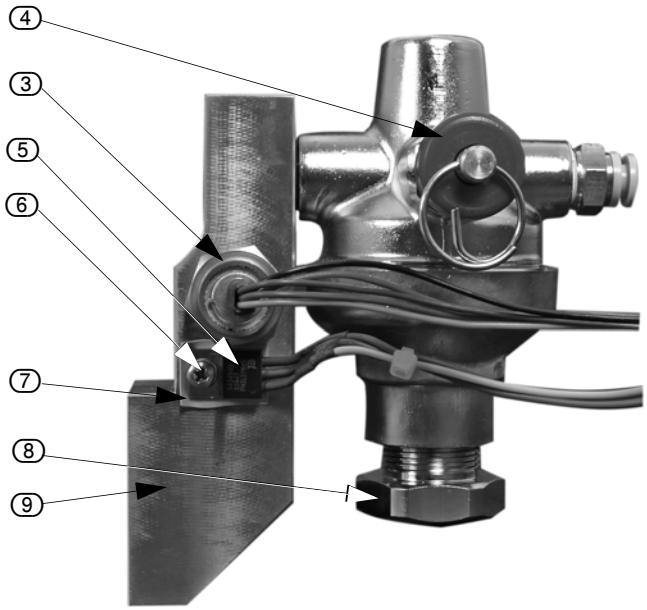
Fig. 6-4 High pressure unit HPU

(1) Connection for gas tube
(2) High pressure regulator
(3) Pressure sensor
(4) High pressure safety valve HSV

EN

Fig. 6-5 High pressure unit HPU (side view)

④ High pressure safety valve
⑤ Heater/temperature sensor
⑥ Fastening screw/insulating bush
⑦ Insulating disk, silicone
⑧ High pressure regulator setting screw
⑨ Adapter 01 for HPU (metal block)



If these functional elements malfunction and/or the cause of the detected flow restriction has been determined, the component has to be replaced.

1. Open case as described under 3.6 Opening the Device .
2. Remove gas supply connection as described in chapter 6.1 Uninstalling/Installing Gas Supply Connection .
3. Remove the gas tube from the HPU ① and pull off plugs ST3 + ST5 from PCU board (see also Fig. 6-6 Position of low pressure unit LPU).
4. Unscrew the four fastening screws from the rear panel (see Fig. 6-1 Position of gas supply connection) and remove the HPU.
5. Follow these steps in reverse for assembly.

Perform the following tests/calibrations after installing a new HPU high pressure unit:

- Testing the HPU for leaks (see 4.6.4 Checking High Pressure Unit HPU for Leaks)
- Offset calibration (see chapter 5.4 Offset Calibration)
- HIGH-pressure calibration (see chapter 5.6 HIGH Pressure Calibration)

6.2.1 Replacing the Heater/Temperature Sensor

To replace the heater/temperature sensor ⑤, the high pressure unit HPU must be removed. Heater and temperature sensor are combined in one component. Remember the exact use and position of the associated insulating bush and insulating disk when replacing these components. The associated SMD fuse is located on the PU board and can be replaced there (see Fig. 4-8 Position of SMD fuse).

EN

6.3 Uninstalling/Installing Low Pressure Unit LPU

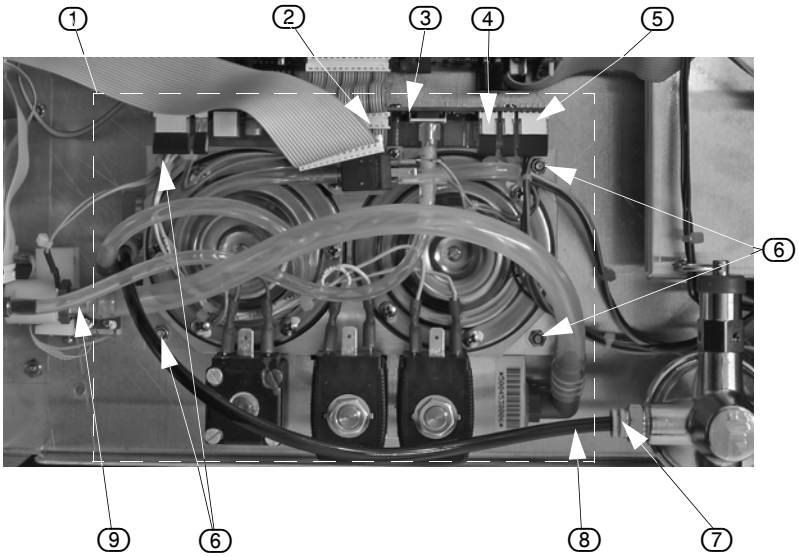


Fig. 6-6 Position of low pressure unit LPU

1. Low pressure unit (LPU)
2. ST1 plug/flat ribbon cable
3. PCU board
4. Plug ST3/cable leading to high pressure sensor
5. Plug ST5/cable leading to heater
6. 4 x fastening nuts M4/toothed washer
7. High pressure tube HPT connection
8. High pressure tube HPT
9. Low pressure tube LPT connection

In case of malfunction of the pressure regulator and/or unacceptable flow reduction, the pneumatic unit LPU must be replaced.

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove the ST1 plug /cable (2) from the PCU board (3) by pulling up.
3. Remove the ST3 plug /cable (4) and ST5/cable (5) from the PCU board by pulling towards side.
4. Remove the high pressure tube as depicted by item (7) and the low pressure tube as depicted by item (9) (see also Fig. 4-5 High pressure unit HPU).
5. Use a SW 4 socket wrench to remove the four fastening nuts (6) and lift out the entire unit by pulling straight up.
6. Follow these steps in reverse for assembly.

The following tests/updates must be performed after installing a new low pressure unit LPU:

- Software update via Global Services.net
- Testing the Low Pressure Unit LPU for Leaks
- Basic function test
- Safety test (see chapter 4.1 Safety Test)

EN

6.4 Uninstalling/Installing PPV Valve

Fig. 6-7 Position of PPV valve

① PPV valve
② PCU board
③ 3x fastening screws
④ ST8 plug/cable leading to PCU
⑤ 2x tube connection PPV

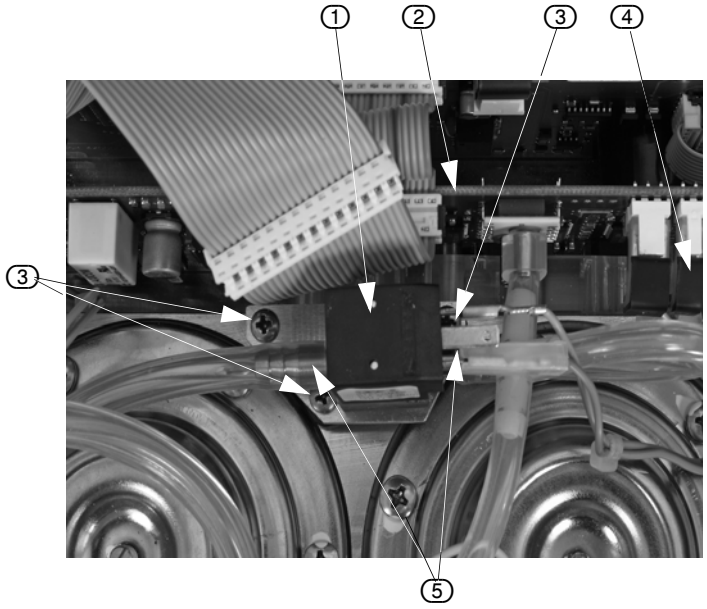
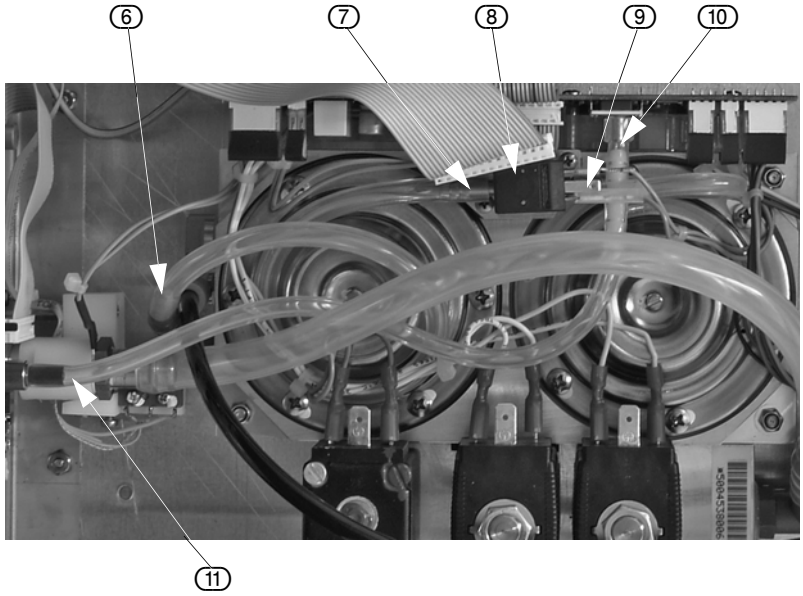


Fig. 6-8 Tube connection variation A

⑥ LPU tube connection
⑦ PPV tube connection
⑧ PPV valve
⑨ PPV tube connection
⑩ Tube connection pressure sensor PPS (PCU board)
⑪ Tube connection for RTP system



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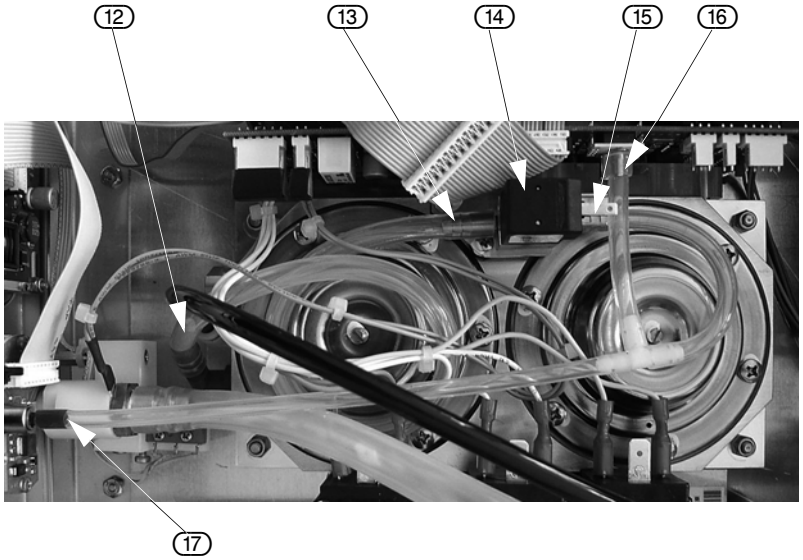


Fig. 6-9 Tube connection variation B

(12) LPU tube connection
(13) PPV tube connection
(14) PPV valve
(15) PPV tube connection
(16) Tube connection pressure sensor PPS (PCU board)
(17) Tube connection for RTP system

The PPV valve must be replaced if defective or malfunctioning.

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove the ST8 plug /cable (4) from the PCU board (2) by pulling towards side.
3. Remove the two tubes from the PPV valve as depicted in item (5).
4. Unscrew the 3 Phillips screws (3) and remove the PPV valve (1) from the device by pulling up together with the support plate.
5. Follow these steps in reverse for assembly. Make sure the connected tubes are not kinked or clamped in any way when installing the PPV valve. Two different tube connection variations are possible, see Fig. 6-8 Tube connection variation A and Fig. 6-9 Tube connection variation B. Align and position the tubes as depicted in the illustration when replacing these tubes. When connecting to the pressure sensor (10), make sure to connect the tube to the upper connection.

The following tests have to be performed after installing a new PPV valve:

- Basic function test
- Safety test (see chapter 4.1 Safety Test)

EN

6.5 Uninstalling/Installing Power Supply Unit

Fig. 6-10 Position of power supply unit

① Power supply unit cover

② 4x nuts/toothed washers

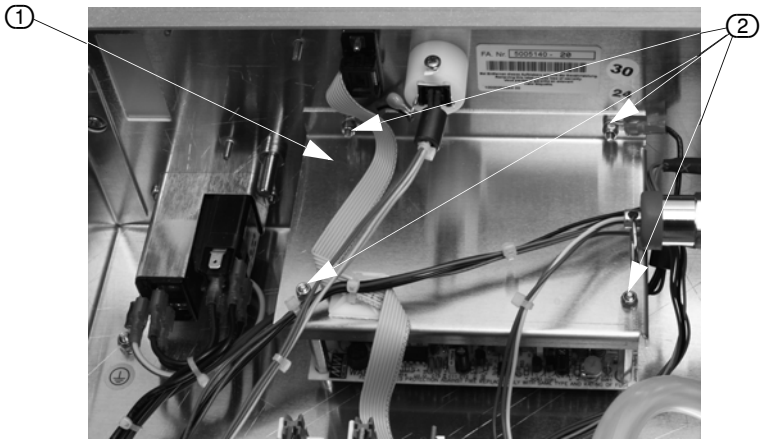


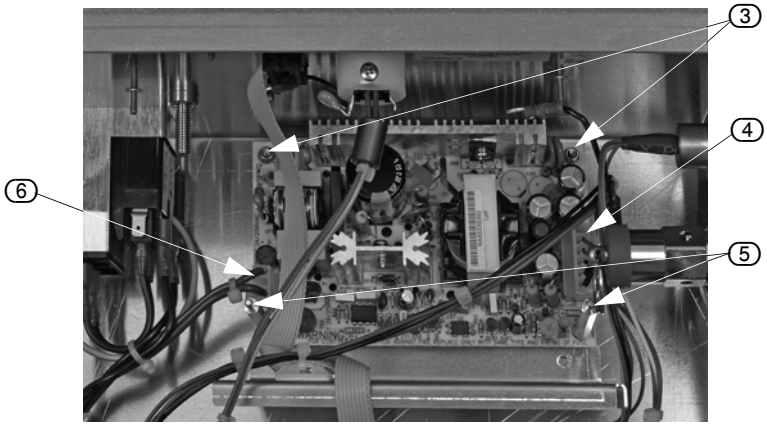
Fig. 6-11 Power supply unit without cover

③ 2x nuts/toothed washers

④ Power supply unit output plug

⑤ 2x stay bolts, large

⑥ Power supply unit, plug input



If the power supply unit/fuse fails or malfunctions repeatedly, the components have to be replaced.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Use a SW 5.5 wrench to loosen the four fastening nuts/washers ② and pull off the cover plate ①.
3. Detach the plugs ④ and ⑥ from the power supply unit board.
4. Remove the 2 large stay bolts ⑤ using a SW 5.5
5. wrench.
6. Unscrew the 2 nuts/washers ③ and lift off the power supply board by pulling up.
7. Follow these steps in reverse for assembly.

The following tests have to be performed after installing a new power supply unit:

- Connect to the power supply and turn on device.
- Use a multimeter to check the voltage of the power supply unit at the input plug ⑥ (100-240 V~) and at the output plug ④ (24V=).
- Perform a safety test as described in chapter 4.1 Safety Test .

EN

6.6 Uninstalling/Installing Mains Socket with Fuse Holder

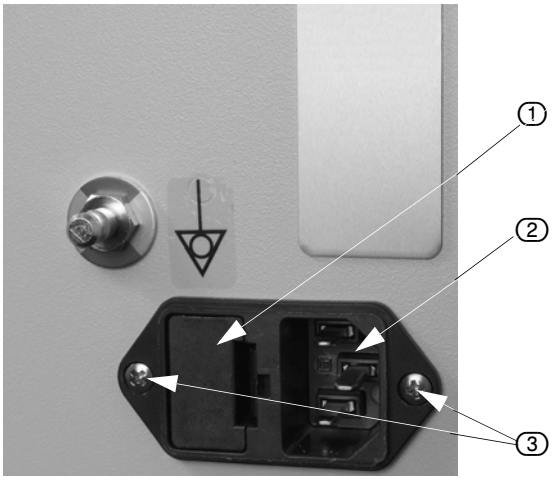


Fig. 6-12 Position of mains socket

① Fuse holder
② Mains socket
③ 2x fastening screws

Fig. 6-13 Mains socket (rear side, inside)

④ Cable for mains socket
⑤ Grounding connection

If the mains socket is damaged or malfunctions, the component must be replaced in its entirety. The mains socket module is supplied as a replacement module including all screws, cables with plugs, line filter, and fuse holder.

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Cut the cable ties of the cables leading to the NET board.
3. Pull ST2 plug from NET board (see also Fig. 6-20 Detail A: Power switch/NET board).
4. Remove ground wire connection cable ⑤ from bottom of case.
5. Remove the two fastening screws ③ from the outer rear panel and remove the mains socket with the cables by pulling towards back.
6. Follow these steps in reverse for assembly.

The following tests must be performed after installing a new mains socket with fuse holder:

- Basic function test
- Safety test (see chapter 4.1 Safety Test)

EN

6.7 Uninstalling/Installing Potential equalization MC-Plug

Fig. 6-14 Position of potential equalization plug

① Potential equalization plug

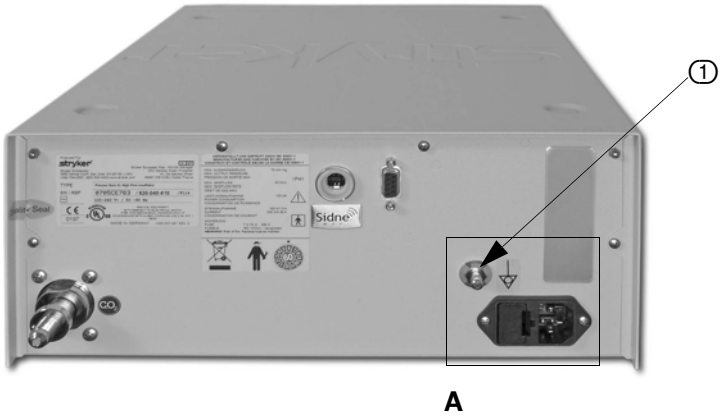
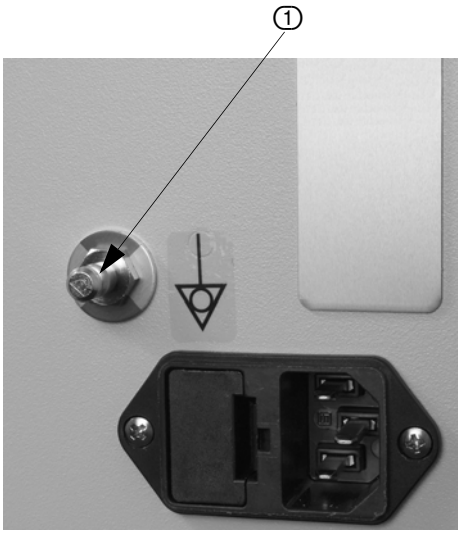


Fig. 6-15 Detail A: Potential equalization plug

① Potential equalization plug



DANGER!

Disconnect device from power supply.

1. Remove power connection cable from mains socket.
2. Use a size 10 socket wrench to remove the potential equalization plug ① from the rear panel of the device.
3. Follow these steps in reverse for assembly.

Perform the following tests after installing the new component:

- Electrical safety test (see chapter 4.1 Safety Test).

EN

6.8 Uninstalling/Installing MIO/Board MIO LCD

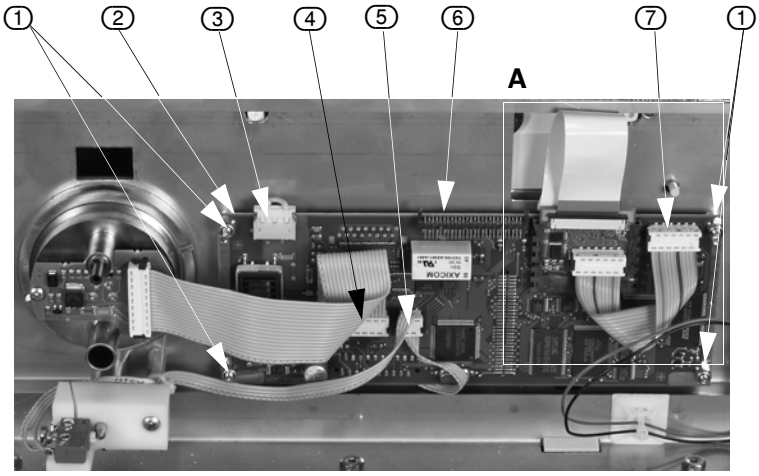


Fig. 6-16 Position of MIO/MIO LCD board

(1) 4x fastening screws
(2) MIO board
(3) Plug ST1/cable leading to touch display
(4) ST6 plug/cable leading to HPL board
(5) Plug ST5/cable leading to light sensor or tube detection
(6) Plug ST8/flat ribbon communication cable
(7) Plug ST10/cable leading to MIO LCD board

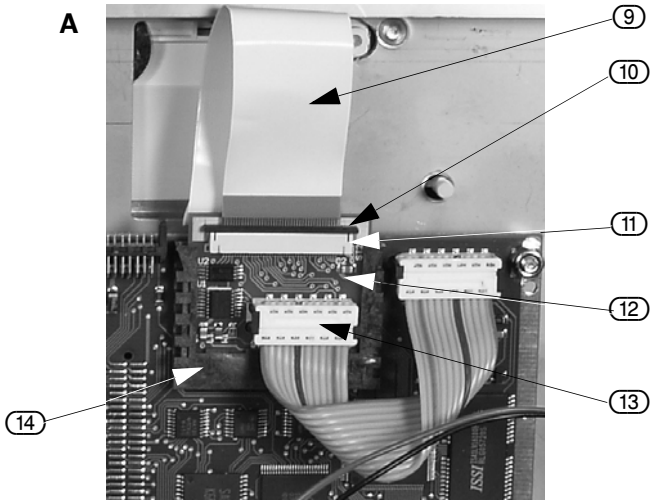


Fig. 6-17 Detail A: MIO LCD board

(9) Flat ribbon cable LCD
(10) ST2 plug latching
(11) ST2 plug
(12) MIO LCD board
(13) Plug ST3/cable leading to MIO board
(14) Board bracket

DANGER!

Disconnect device from power supply.

Uninstalling/installing MIO board

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove device front panel as described in chapter 6.14 Uninstalling/Installing Device Front .
3. Remove fluid sensor as described in chapter 6.13 Uninstalling/Installing Fluid Sensor .
4. Remove the ST1 plug (3) and ST8 plug (6) from the MIO board by pulling towards side.
5. Remove the ST5 plug (5), ST6 plug (4), and ST10 plug (7) from the rear MIO board by pulling towards side.
6. Remove MIO LCD board by pulling up from the board bracket.
7. Remove the fastening nuts (1) and lift out the MIO board.
8. Follow these steps in reverse for assembly.

Perform the following tests/calibrations after installing the new component:

EN

- Basic function test
- Safety test (see 4.1 Safety Test)
- Touch display calibration

Uninstalling/installing MIO LCD board

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove the ST3 plug (13) from the MIO LCD board by pulling parallel towards top.
3. Remove the MIO LCD board by pulling up from the board bracket (14).
4. Disconnect the plug connection ST2 (11) by sliding carefully between latch (10) and plug (11) with your fingernail. Pull flat ribbon cable for LCD. Note: When reinstalling the components, make sure the flat ribbon cable is inserted straight into the open latch and up to the stop. Do not insert the flat ribbon cable between plug and circuit board - make sure you insert the ribbon cable properly into the corresponding connector. Then close the latches (10).
5. Follow these steps in reverse for assembly.

Perform the following tests/calibrations after installing the new component:

- Basic function test
- Safety test (see 4.1 Safety Test)
- Touch display calibration

EN

6.9 Uninstalling/Installing BAM Board

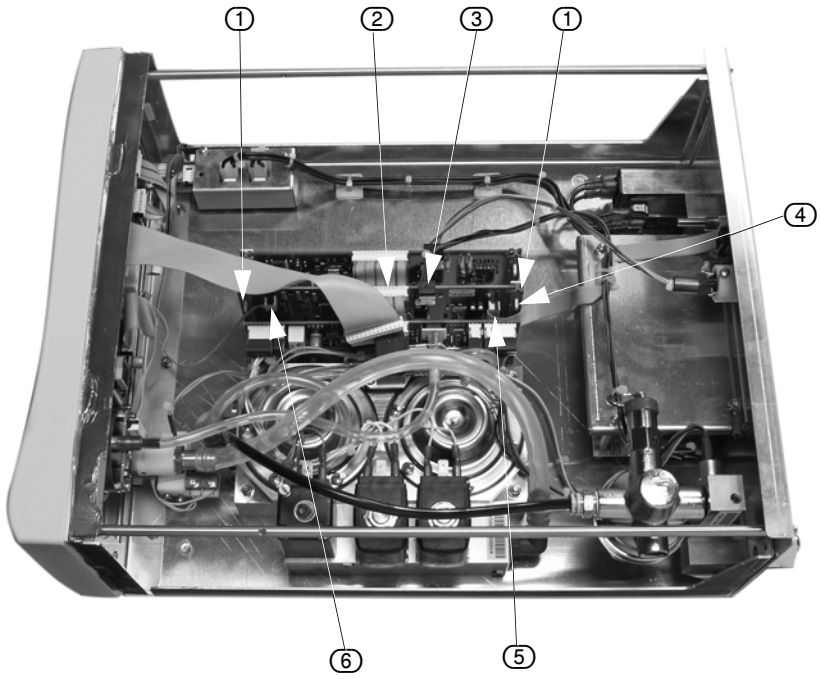


Fig. 6-18 Position of BAM board

(1) 2x board latches
(2) Plug ST1/flat ribbon communication cable
(3) ST3 plug/cable leading to power supply unit
(4) BAM board
(5) ST4 plug/flat ribbon cable leading to service interface
(6) ST2 plug/cable leading to NET board

In case of malfunction (dark touch display, green LED no longer lights up, no LED on board is illuminated), the BAM board must be replaced completely.

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove the ST4 plug (3) from the BAM board by pulling up.
3. Remove the ST1 plug (2) from the BAM board and the IFM board by pulling parallel towards top.
4. Press to release the two board latches from the board and pull out the board until it extends slightly towards top.
5. Remove the ST2 plug (6) and ST4 plug (5)from the BAM board by pulling vertically.
6. Completely remove BAM board (4) from device.
7. Follow these steps in reverse for assembly.

Perform the following tests/updates after installing the new component:

- Software update via Global Services.net
- Basic function test
- Safety test (see chapter 4.1 Safety Test)

EN

6.10 Uninstalling/Installing NET Board/Power Switch

Fig. 6-19 Position of power switch/NET board

① Power switch/NET board

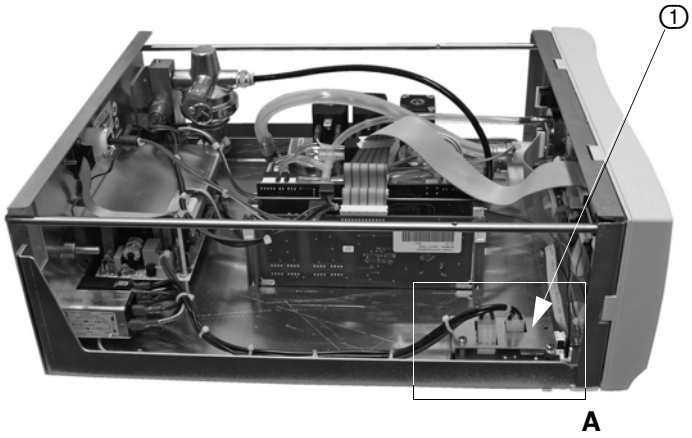


Fig. 6-20 Detail A: Power switch/NET board

② Plug ST2/cable leading to mains socket

③ ST1 plug/cable leading to PSM power supply unit board

④ ST3 plug/cable leading to BAM board

⑤ Dummy plug

⑥ ST4 plug/cable leading to power switch LED

⑦ 2x fastening screws

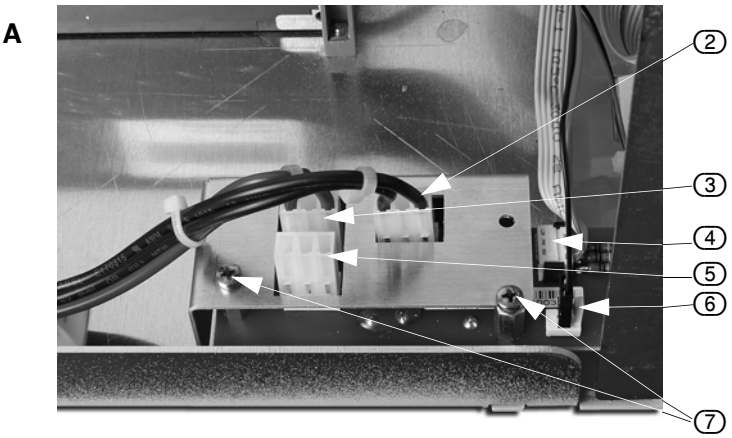


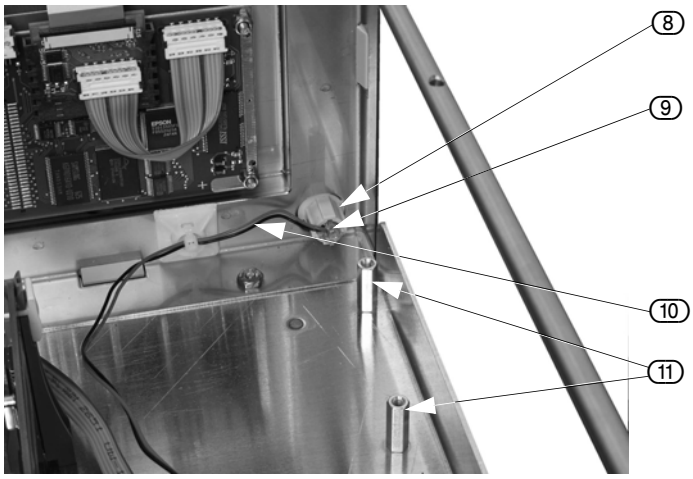
Fig. 6-21 Mains switch

⑧ Guide for power switch

⑨ Power switch with LED

⑩ Cable for LED

⑪ Stay bolts for NET board



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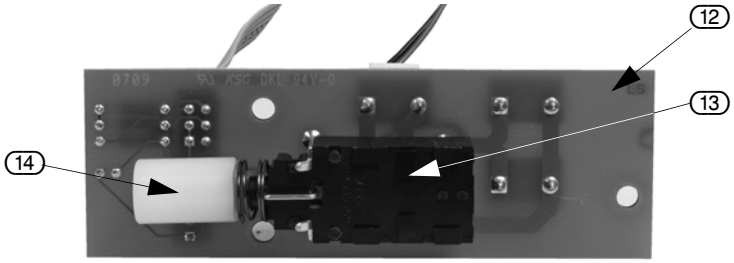


Fig. 6-22 NET board

(12) Bottom side of the NET board
(13) Mains switch
(14) Power switch sleeve (pluggable)

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove plugs ST1 (2), ST2 (3), ST3 (4), and ST4 (6) from the NET board.
3. Remove the dummy plug (5) from the NET board and keep this plug.
4. Unscrew 2 fastening screws (7) and remove the board by pulling up.
5. Follow these steps in reverse for assembly. Make sure the power switch sleeve (14) is positioned on or plugged into the plunger of the switch.

Uninstalling the power switch knob

The power switch knob is slipped into the opening at the front of the device and clicks into place with two lateral pins. These pins are visible through notches in the guide. The power switch knob can be popped out by carefully pinching these pins together and applying axial pressure at the same time. The LED is glued into the power switch knob and thus forms one unit. When replacing the NET board or the power switch knob, make sure the LED cable extends from the side of the switch and is level with the front surface of the power switch knob.

The following tests must be performed after installing the NET board:

- Basic function test
- Safety test (see chapter4.1 Safety Test)

EN

6.11 Uninstalling/Installing IFM Board/ SIDNE Interface

Fig. 6-23 Position of SIDNE interface

① Ring nut

② SIDNE interface

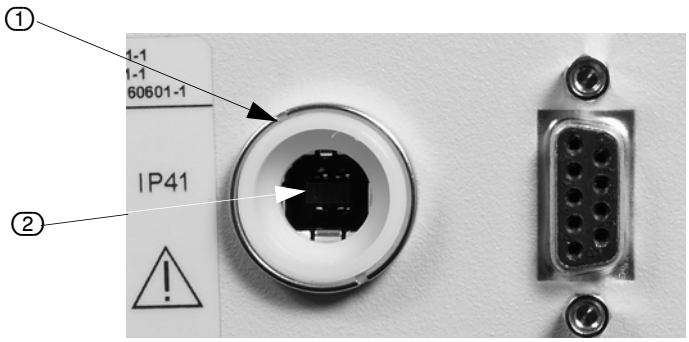


Fig. 6-24 SIDNE interface (rear device panel, inside)

③ Capacitor connection

④ Cable leading to IFM board

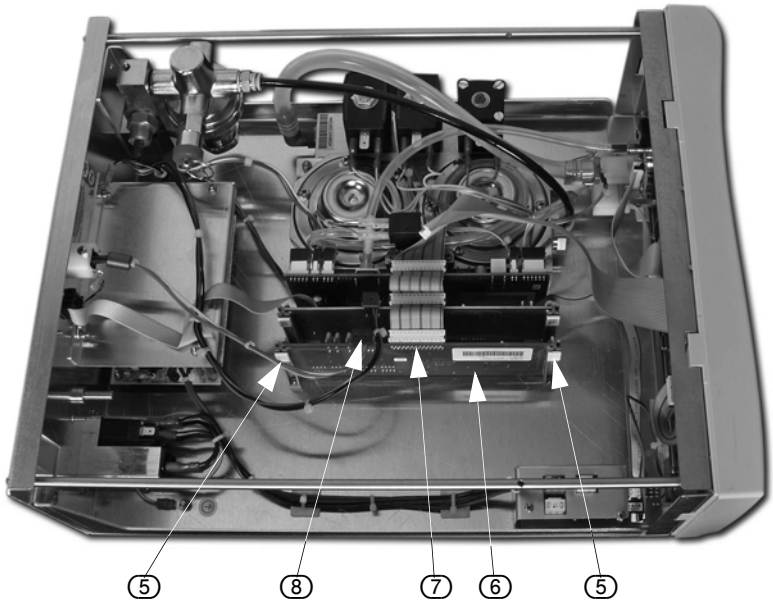
Fig. 6-25 Position of IFM board

⑤ Board latch

⑥ IFM board

⑦ ST1 plug/flat ribbon communication cable

⑧ ST2 plug/cable leading to SIDNE interface



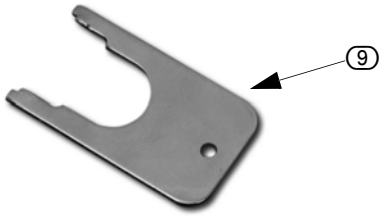


Fig. 6-26 Ring nut wrench

(9) Box wrench for M18x1

If the SIDNE interface is damaged or the speech control malfunctions, the SIDNE interface/IFM board must be replaced.

DANGER!

Disconnect device from power supply.

Uninstalling/installing IFM board

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove plugs ST1 (7) and ST2 (8) from the IFM board (6) by pulling parallel towards top.
3. Press to release the board latches (5) from the board.
4. Remove IFM board (6) by pulling up.
5. Follow these steps in reverse for assembly.

The following tests/updates must be performed after installing a new IFM board:

- Software update
- Basic function test
- Safety test (see chapter 4.1 Safety Test)

Uninstalling/installing the SIDNE interface

1. Remove cable of the capacitor (3) from the rear of the device panel.
2. Remove the ST2 plug (8) from the IFM board.
3. Unscrew the ring nut (1) at the outside of the rear device panel using a a ring nut wrench (9).
4. Remove SIDNE interface by pulling towards inside of device.

The following tests have to be performed after installing a new SIDNE interface:

- Basic function test
- Safety test (see chapter 4.1 Safety Test)

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6.12 Uninstalling/Installing HPL Board

Fig. 6-27 Position of HPL board

① HPL board
② ST1 plug/flat ribbon cable
③ 2x fastening screws M2.5

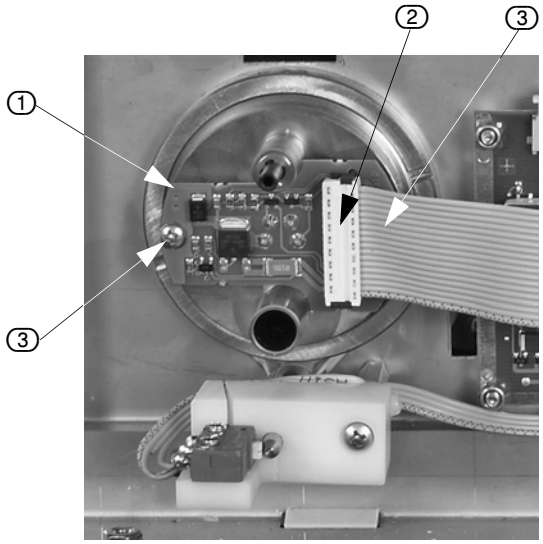
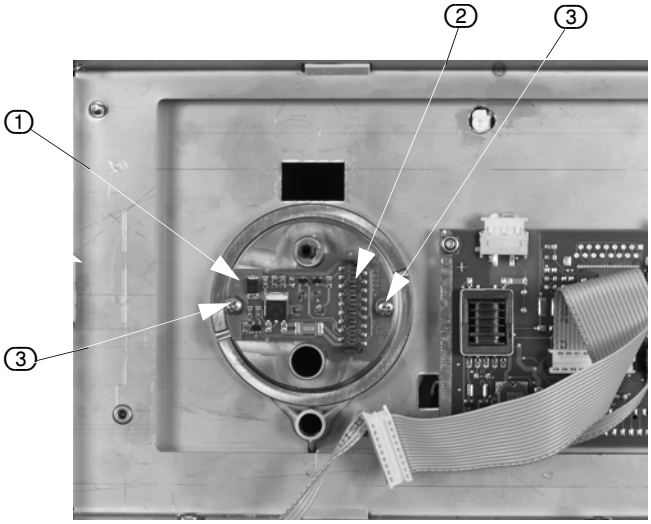


Fig. 6-28 Position of HPL board

① HPL board
② ST1 plug/flat ribbon cable
③ 2x fastening screws M2.5



In case of malfunction of the gas tube heating and/or damage to the tube connection, the HPL board must be replaced.

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove device front panel as described in chapter 6.14 Uninstalling/Installing Device Front .
3. Remove the ST1 plug /cable ② from the rear HPL board ① by pulling parallel to the top.
4. Unscrew the two fastening screws ③ and remove the HPL board. Make sure the O-ring remains in place when removing the component.
5. Follow these steps in reverse for assembly. Make sure the O-ring is in place when installing the component.

The following tests must be performed after installing a new HPL board:

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- Basic function test
- Leak test (see chapter 4.8 Testing the Low Pressure Unit LPU for Leaks)
- Testing gas heating with heating tube
- Safety test (see chapter 4.1 Safety Test)

6.13 Uninstalling/Installing Fluid Sensor

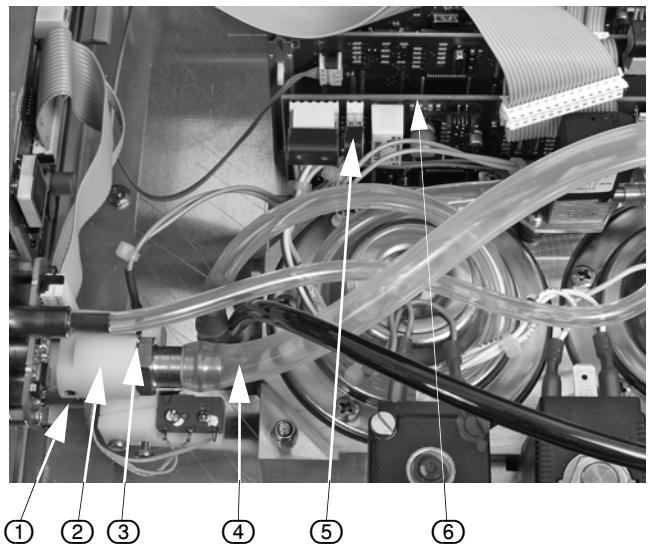

Fig. 6-29 Position of fluid sensor

① 1x tube connection setscrew
② Fluid sensor sleeve
③ Fluid sensor
④ Tube leading to low pressure unit LPU
⑤ ST6 plug/cable leading to PCU board
⑥ PCU board

The fluid sensor must be replaced if defective or malfunctioning.

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove the ST6 plug /cable ⑤ from the PCU board ⑥ by pulling towards side.
3. Use a SW 2 Allen wrench to remove the setscrew ① and remove the sleeve in ② axial direction.
4. Remove the low pressure tube at position ④.
5. Follow these steps in reverse for assembly.

The following tests must be performed after installing a new fluid sensor:

- Leak test (see chapter 4.8 Testing the Low Pressure Unit LPU for Leaks)
- Fluid sensor test (see chapter 4.11 Fluid Sensor Test)
- Safety test (see chapter 4.1 Safety Test)

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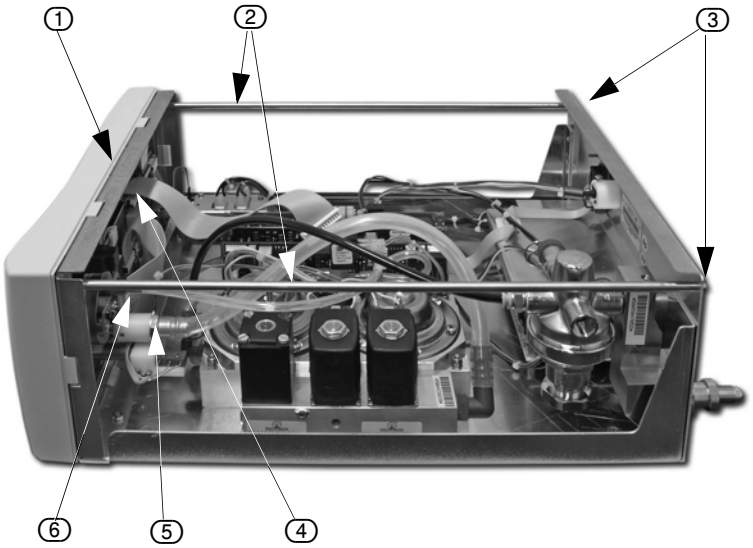
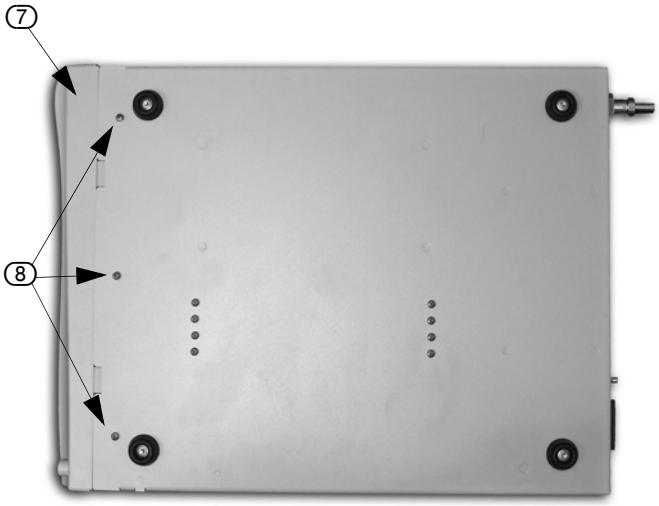
6.14 Uninstalling/Installing Device Front

Fig. 6-30 Position of device front



1. Device front
2. 2x con-rods
3. 2x cap nuts (device rear)
4. ST8 plug on MIO board/cable leading to PCU
5. Fluid sensor
6. Patient pressure measurement connection

Fig. 6-31 Device base



7. Device front
8. 3x fastening screws

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove the three fastening screws (8) on the bottom of the device (underside).
3. Remove the two cap nuts (3) of the con-rods on rear of device.
4. Turn the two con-rods (2) counterclockwise to remove them from the front of the device. This can be done with the help of a hex key or Allen wrench, for example, inserted into the hole of the con-rod.
5. Remove fluid sensor from tube connection as described in chapter 6.13 Uninstalling/Installing Fluid Sensor .
6. Remove the patient pressure measurement tube at position (6).
7. Remove the plug ST4/cable leading to the power switch LED from the NET

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board (see Fig. 6-20 Detail A: Power switch/NET board, position ⑤).
8. Remove the ST8 plug/cable ④ from the IMO board.
9. Lift the device front panel ① from the device case.
10. Follow these steps in reverse for assembly.

The following tests must be performed after installing a new device front:

- Basic function test
- Safety test (see chapter 4.1 Safety Test)

The device front panel is to be removed when replacing the MIO or HPL board or the touch display, the tube connection and the tube detection to ensure proper access to these components.

6.15 Uninstalling/Installing Tube Connection

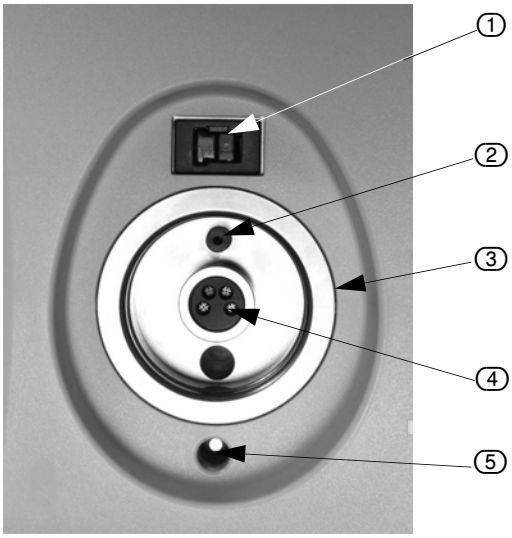

Fig. 6-32 Position of tube connection

① Snap lock
② Patient pressure measurement connection
③ Tube connection
④ HPL board (tube heater)
⑤ Tube detection

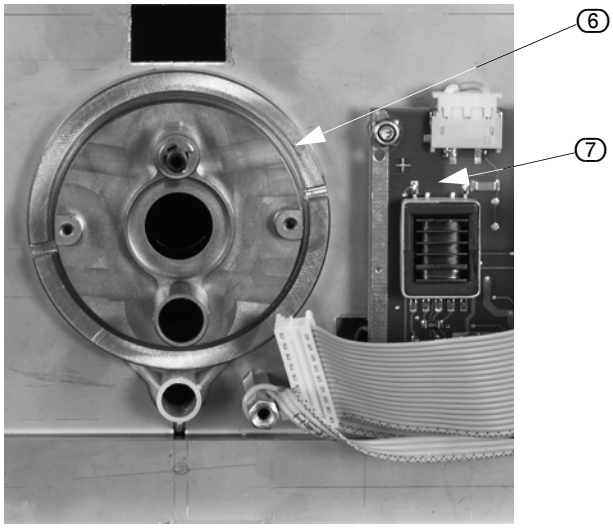

Fig. 6-33 Tube connection

⑥ Tube connection brass ring
⑦ MIO board

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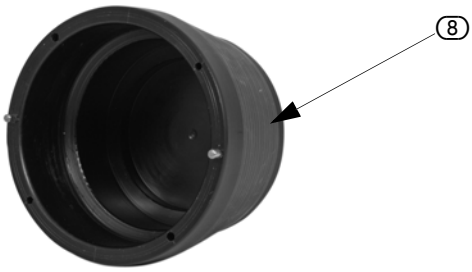
Fig. 6-34 Assembly key

(8) Assembly wrench for tube connection



DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove device front panel as described in chapter 6.14 Uninstalling/Installing Device Front .
3. Pull ST1 plug from HPL board (see chapter 6.12 Uninstalling/Installing HPL Board).
4. Turn the brass ring of the tube connection (6) counterclockwise using the assembly key (8) to remove from tube connection threading and take the tube connection out off the device front.
5. Follow these steps in reverse for assembly. Make sure the correct turning direction is observed during installation (see Fig. 6-32 Position of tube connection).

The following tests must be performed after installing a new tube connection:

- Basic function test
- Testing the Low Pressure Unit LPU for Leaks
- Safety test (see chapter 4.1 Safety Test)

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6.16 Uninstalling/Installing Tube Detection

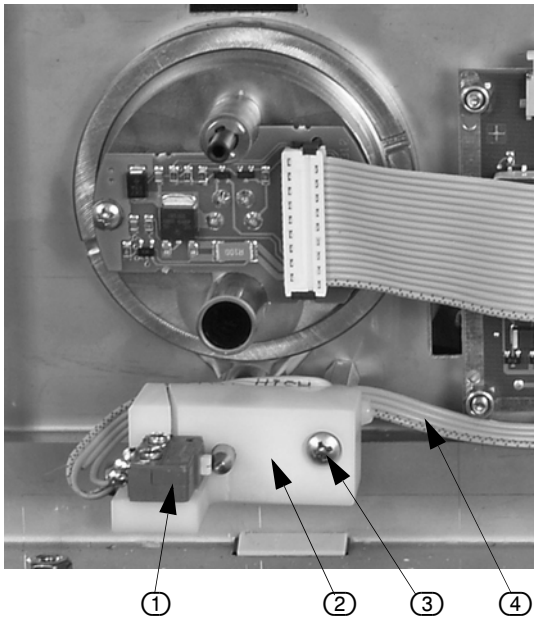

Fig. 6-35 Position of tube detection

① Micro switch
② Tube detection holder
③ 1x fastening screw
④ ST6 plug/cable leading to MIO board

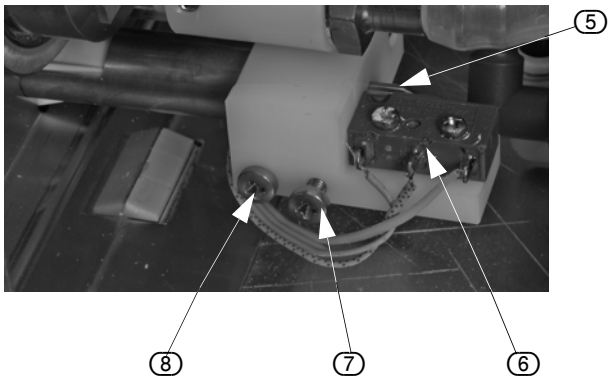

Fig. 6-36 Adjusting the trigger sensitivity

⑤ Plunger
⑥ Micro switch
⑦ Locknut screw
⑧ Setting screw

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove device front panel as described in chapter 6.14 Uninstalling/Installing Device Front .
3. Remove tube connection as described in chapter 6.15 Uninstalling/Installing Tube Connection.
4. Uninstall the MIO board MIO LCD as described in chapter 6.8 Uninstalling/Installing MIO/Board MIO LCD .
5. Remove adhesive copper tape from device front (see Fig. 6-43 Remove faceplate, page 65).
6. Carefully press the six catches (plastic) into the frame so that the faceplate (plastic) can be removed from the device front (see Fig. 6-43 Remove faceplate, page 65).
7. Remove the light sensor from the faceplate (see Fig. 6-40 Position of touch display, page 64).
8. Remove the ST6 plug/cable leading to the tube detection ④ from the IMO

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board and untie any existing cable ties.

9. Remove the fastening screw (3) and pull the tube detection (2) from the device front.
10. Follow these steps in reverse for assembly.

After installation, the trigger sensitivity of the tube detection must be checked and adjusted if necessary Follow these steps:

1. Press the plunger (5) to check whether the micro switch (6) is triggered (listen for a clicking sound). If this is not the case, set the trigger sensitivity of the tube detection as described in section 2 and 3:
2. Set the distance of the micro switch to the plunger by turning the setting screw (8) until the micro switch is triggered (listen for clicking sound).
3. Then tighten the locknut screw (7) in place.

The following tests must be performed after installing a new tube detection:

- Basic function test
- Safety test (see chapter 4.1 Safety Test)

6.17 Uninstalling/Installing Snap Lock

Fig. 6-37 Position of snap lock

(1) Tube connection

(2) Snap lock

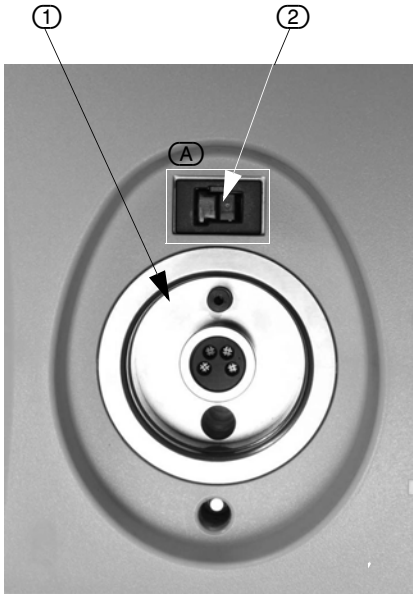

Fig. 6-38 Detail A: Snap lock

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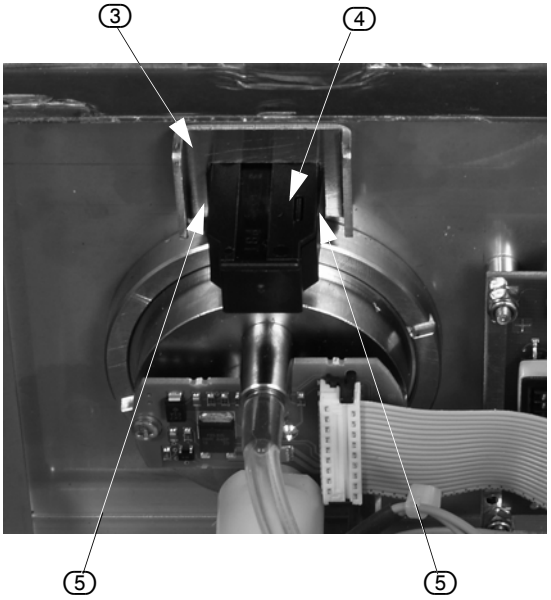

Fig. 6-39 Snap lock rear

(3) Clamping plate
(4) Snap lock
(5) 2x catches, lateral

DANGER!

Disconnect device from power supply.

1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove the clamping plate (3) from snap lock by pulling.
3. Press the two catches (5) to the left and right of the snap lock (4) towards the outside to remove snap lock (4) from device front.
4. Follow these steps in reverse for assembly. Make sure the snap lock (2) is positioned correctly when installing (see Fig. 6-38 Detail A: Snap lock).

The following tests must be performed after installing a new snap lock:

- Basic function test
- Safety test (see chapter 4.1 Safety Test)

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6.18 Uninstalling/Installing Touch Display

Fig. 6-40 Position of touch display

① Clamping angle square
② Display touch panel
③ Cable leading to MIO board
④ Device front without faceplate
⑤ Light sensor for MIO board/tube detection
⑥ Metallic stops

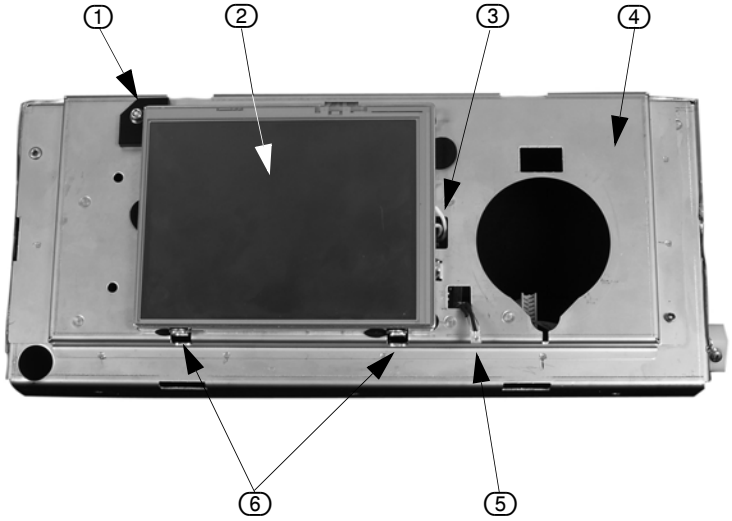


Fig. 6-41 Touch display, rear

⑦ Display touch panel
⑧ ST1 plug/cable leading to MIO board
⑨ Flat ribbon cable LCD

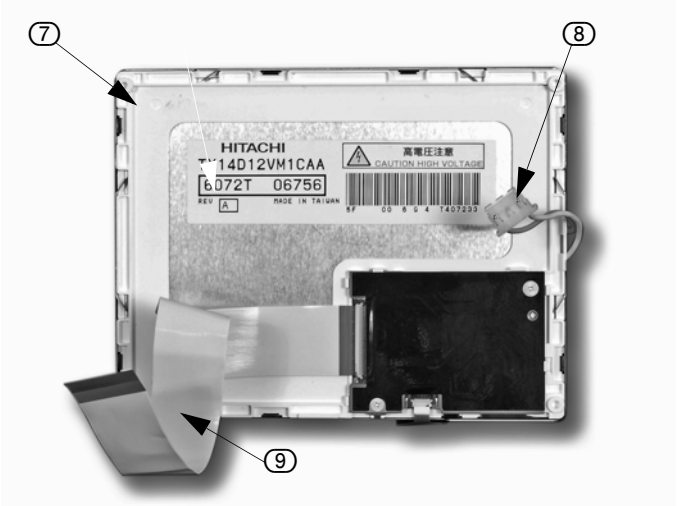
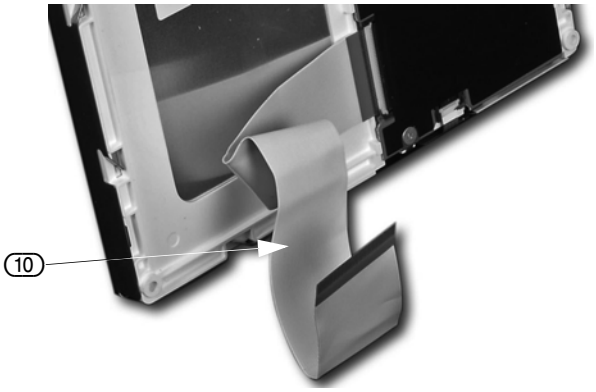


Fig. 6-42 Flat ribbon cable LCD

⑩ Flat ribbon cable LCD



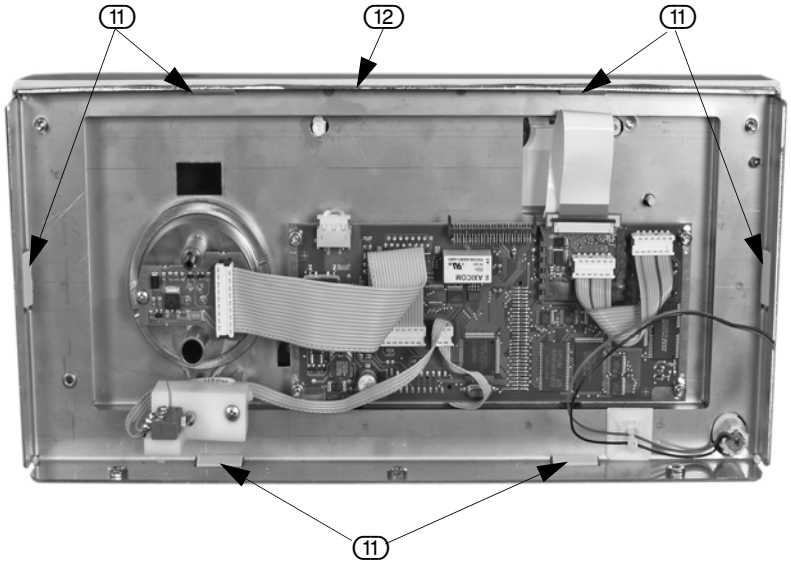


Fig. 6-43 Remove faceplate

(11) 6x catches, faceplate
(12) Adhesive copper tape

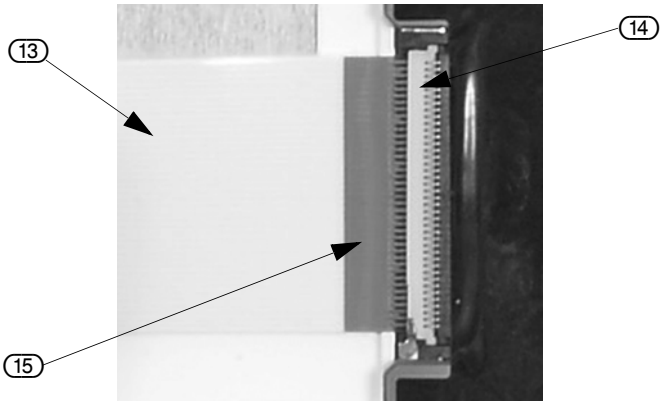


Fig. 6-44 Flat ribbon cable LCD latch

(13) Flat ribbon cable LCD
(14) LCD latch
(15) Blue marking

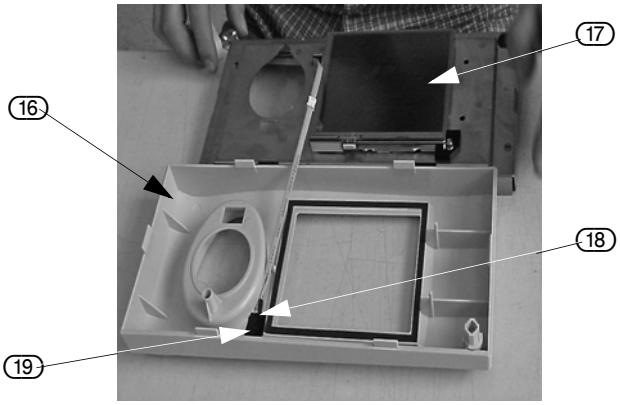


Fig. 6-45 Light sensor fastening

(16) Faceplate
(17) Touch display
(18) Light sensor
(19) Adhesive cloth tape, black

DANGER!

Disconnect device from power supply.

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1. Open the device as described in chapter 3.6 Opening the Device .
2. Remove device front panel as described in chapter 6.14 Uninstalling/Installing Device Front .
3. Remove tube connection as described in chapter 6.15 Uninstalling/Installing Tube Connection.
4. Uninstall the MIO board MIO LCD as described in chapter 6.8 Uninstalling/Installing MIO/Board MIO LCD .
5. Remove adhesive copper tape (12) from device front.
6. Carefully press the six catches (plastic) (11) into the frame so that the faceplate (plastic) can be removed from the device front.
7. Remove the light sensor (5) from the faceplate.
8. Remove tube detection as described in chapter 6.16 Uninstalling/Installing Tube Detection, page 61 .
9. Remove the angle square (1) and carefully lift the touch display off from the device front.
10. Follow these steps in reverse for assembly.

Follow these steps to install a touch display:

1. Flip the latch (14) up and insert the LCD flat ribbon cable (13) with the blue marking (15) pointing up into the latch. Flip latch down to fix flat ribbon cable in place.
2. Carefully shape the LCD flat ribbon cable (10) by bending according to Fig. 6-42 Flat ribbon cable LCD .
3. Place the touch display on the front panel and align with the help of the metallic stops (6) and the clamping angle square (1). Use a size SW5.5 jaw wrench to tighten the screw of the angle square (1).
4. Remove the protective foil from the touch display.
5. The light sensor is inserted through the front opening and fastened to the faceplate with black adhesive cloth tape (see Fig. 6-45 Light sensor fastening).
6. Attach faceplate to front.

The following tests/calibrations must be performed after installing a new touch display:

- Basic function test
- Touch display calibration
- Leak test (see chapter 4.8 Testing the Low Pressure Unit LPU for Leaks)
- Safety test (see chapter 4.1 Safety Test)

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7 Spare Parts List

Designation	Article No.
High pressure unit HPU 03, complete	2200906
Pneumo Sure power supply unit, complete	2203123
Mains socket	2200989
BAM 03 board basic module	2203125
MIO board - Pneumo Sure	2203126
MIO LCD board	2203127
Heating board Pneumo Sure (HPL board)	2203120
Low pressure unit LPU 04	2203124
SIDNE board	2203133
Potential equalization MC plug, USA	2201560
Power switch assembly	2201317
Power control board Pneumo Sure (NET board)	2203122
Display touch panel	2203134
Heater/temperature sensor	2200892
SMD fuse 2 A, super-fast-acting (for PCU/heater)	2201798
O-ring (seal for gas supply connection)	2201377
Gas connection US	2200694
Snap lock	2203132
Pneumo Sure fluid sensor	2203118
Tube connection	2203129
Tube detection	2203130
PPV valve	2203128
Insufflator Pneumo Sure set of cables	2203121
Insufflator Pneumo Sure set of tubes	2203131
Pneumo Sure bottom case	2203119
Case lid, Stryker	2200730
Pneumo Sure front	2203135
Calibration adapter	2203150
Assembly key for Pneumo Sure	2203139

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8 Error and Warning Messages

Error message	Cause of error	Troubleshooting
0	General error	Replace LPU
1	Timeout	Replace LPU
2	General software error	Replace LPU
3	EEPROM write error	Replace LPU
4	General gas supply error	Check gas supply
10	Offset I low pressure sensor too low	Replace LPU
11	Offset II low pressure sensor too low	Replace LPU
12	Offset safety pressure sensor too low	Replace LPU
13	Offset differential pressure sensor too low	Replace LPU
14	Offset high pressure sensor too low	Replace HPU
15	Offset temperature sensor too low	Replace LPU
16	Offset current monitor of high pressure gas heating too low	Replace LPU
17	Offset gas heating too low	Replace LPU
20	Offset I low pressure sensor too high	Replace LPU
21	Offset II low pressure sensor too high	Replace LPU
22	Offset safety pressure sensor too high	Replace LPU
23	Offset differential pressure sensor too high	Replace LPU
24	Offset high pressure sensor too high	Replace HPU
25	Offset temperature sensor too high	Replace LPU
26	Offset current monitor of high pressure gas heating too high	Replace LPU
27	Offset high pressure gas heating too high	Replace LPU or heater
50	General calibration error, low pressure	Check FLS
51	Low pressure – large leak	Check manometer connection
52	Low pressure – small leak	Check manometer connection
53	Low pressure input value too low	Check gas supply, HPU
54	Low pressure input value too high	Check Gas Supply, LPR calibration
55	Low pressure sensor amplification I too low	Replace LPU
56	Low pressure sensor amplification I too high	Replace LPU
57	Low pressure sensor amplification II too low	Replace LPU
58	Low pressure sensor amplification II too high	Replace LPU
59	Safety pressure sensor amplification too low	Replace LPU

Error message	Cause of error	Troubleshooting
60	Low pressure safety pressure sensor amplification too high	Replace LPU
61	Proportional valve malfunction	Replace LPU
62	Patient pressure sensor amplification too low	Replace LPU
63	Patient pressure sensor amplification too high	Replace LPU
70	General calibration error, high pressure	Replace HPU
73	High pressure input value too low	Check gas supply
74	High pressure input value too high	Check gas supply
75	Modified high pressure sensor value	Check gas supply
76	High pressure sensor amplification too low	Replace LPU/HPU
77	High pressure sensor amplification too high	Replace LPU/HPU
90	General calibration error, low pressure regulator	Replace LPU
91	Adjustment, low pressure regulator not within range	Repeat calibration
110	General calibration error, low pressure safety valve	Replace LPU
111	Adjustment, low pressure safety valve not within range	Repeat calibration
130	General error, flow	Check flowmeter, replace LPU
131	Flow resistance too high	Check flowmeter, replace LPU
133	Flow input value too low	Replace LPU
134	Flow input value too high	Replace LPU
135	Modified flow sensor value	Replace LPU
136	Flow sensor amplification too low	Check flowmeter, replace LPU
137	Flow sensor amplification too high	Check flowmeter, replace LPU
138	Offset proportional valve too low	Replace LPU
139	Offset proportional valve too high	Replace LPU
140	Hysteresis proportional valve too low	Replace LPU
141	Hysteresis proportional valve too high	Replace LPU
142	Proportional valve amplification too low	Replace LPU
143	Proportional valve amplification too high	Replace LPU
144	Sticky proportional valve	Replace LPU
255	Test time too long	Repeat calibration

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9 Technical Data

Mains connection cable:	100-240 V~ line fuse T 3.15 A connection for potential equalization
Frequency:	50-60 Hz
Max. power consumption:	150 VA
Max. current consumption:	100 V: 1500 mA 240 V: 630 mA
Classification according to Directive 93/42/EEC:	IIa
Protection class:	I
Protection level:	Type BF
Moisture protection:	IP41
Dimensions:	Width x Height x Depth
	318 x 148 x 475 [mm]
	12.2 x 5.82 x 18.70 [inch]
Weight:	approx. 9 kg / 19.84 lbs
Operating conditions:	10-40°C / 50-104°F 30-75% rel. humidity 700 - 1060 hPa ambient pressure
Storage and transportation conditions:	-30 to +70°C / -22 to +158°F 10-85% rel. humidity 85 - 100% rel. humidity (14 days)
Manufactured and tested according to:	EN 60601-1
EMC:	EN 60601-1-2
Insufflation medium:	Medical CO2
Maximum output pressure:	75 mm Hg (1 mm Hg = 1.33 mbar = 133 Pa)
Maximum gas supply pressure:	80 bar/1160 PSI
Minimum gas supply pressure (bottle):	15 bar/218 PSI
Minimum gas supply pressure (house gas):	3.4 bar/50 PSI
Measurement range of gas supply:	0-50 bar/0-725 PSI
Maximum gas flow:	20 l/min Pediatric 40 l/min High Flow 45 l/min Bariatric 10 l/min Vessel Harvest
Pressure range:	1-20 mm Hg Pediatric/Vessel Harvest 1-30 mm Hg High Flow/Bariatric
Accuracy of pressure measurement:	5%
Accuracy of gas flow measurement:	5%
Accuracy of volume measurement:	10%
Accuracy of gas supply pressure measurement:	10%
Connections (optional):	Data input/output, RS232 interface, SIDNE interface

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10 Abbreviations

Abbreviation	Explanation
BAM	Basic module
DPS	Flow sensor
FLS	Fluid sensor
HPH	High pressure gas heater
HTS	High pressure temperature sensor
HPL	Heater board
HPS	High pressure sensor
HPT	High pressure tube
HPU	High pressure unit
HSV	High pressure safety valve
IFM	Interface module
LCD	Display touch panel
LPT	Low pressure tube
LPR	Low pressure regulator
LPU	Low pressure unit
LSV	Low pressure safety valve
MIO	Multi input/output module
MSV	Median pressure safety valve
NET	Mains switch
OLV	Outlet valve
PCU	Pneumatic control unit
PMS	Pressure measuring sensor
PPS	Patient pressure sensor
PPV	Patient pressure valve
PRV	Proportional valve
PSM	Power supply module (power supply unit)
PWS	Safety pressure sensor
SRV	Service interface
STS	Temperature sensor
VEV	Venting valve

EN

11 Appendix

11.1 Service and Checklist

Date of service: _____

Device type: _____ Serial number: _____

Location of use: _____ Software version: _____

Tester: _____ Company: _____

I: Safety test

Mechanical condition	☐	Front panel and case:	☐	Labels/identifications:	☐
Boards:	☐	Cleanness:	☐		
Mains fuse:	☐	Cabling:	☐		

II. Function test (see service manual)

_____	☐	_____	☐
_____	☐	_____	☐

III. Notes

_____

_____

_____

_____

_____

_____

Date: _____ Signature: _____

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